

# **SAMPLING FOR PESTICIDE RESIDUES IN CALIFORNIA WELL WATER**

## **1997 Update of the Well Inventory Database**

**For Sampling Results Reported From  
July 1, 1996 through June 30, 1997**

Twelfth Annual Report to  
the Legislature,  
Department of Health Services,  
Office of Environmental Health Hazard Assessment,  
and the State Water Resources Control Board

Pursuant to the  
Pesticide Contamination Prevention Act



California Environmental Protection Agency  
DEPARTMENT OF PESTICIDE REGULATION

August 1998

EH98-04



**California Environmental Protection Agency**  
**DEPARTMENT OF PESTICIDE REGULATION**

**Pete Wilson**  
Governor

**Peter M. Rooney**  
Secretary for Environmental Protection

**James W. Wells**  
Director  
Department of Pesticide Regulation





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by  
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SWRCB Portion: Staff

California Environmental Protection Agency  
Department of Pesticide Regulation  
Environmental Monitoring and Pest Management Branch  
Environmental Hazards Assessment Program  
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EH98-04



## **EXECUTIVE SUMMARY**

### **The Pesticide Contamination Prevention Act**

The Pesticide Contamination Prevention Act (PCPA) was enacted in 1985 to prevent further pesticide pollution of the state's ground water. The PCPA requires:

The Department of Pesticide Regulation (DPR) to maintain a statewide database of wells sampled for active ingredients of pesticide products;

Agencies (government and private) to report to DPR the results of any well sampling for the active ingredients of pesticides;

DPR to review findings of pesticide contamination and undertake necessary mitigation;

DPR, in consultation with the California Department of Health Services (CDHS) and the State Water Resources Control Board (SWRCB), to annually make this report to the Legislature, CDHS, the State Office of Environmental Health Hazard Assessment, and SWRCB.

### **The Well Inventory Database**

The well inventory database was developed by DPR (then a division of the California Department of Food and Agriculture) in 1983 before the passage of the PCPA.

The purposes of the database were to centralize information on the occurrence of nonpoint source contamination of ground water by the agricultural use of pesticides and to facilitate graphical, numerical, and spatial analyses of the data.

To meet the requirements of the PCPA, sampling results from both point source and nonpoint source contamination are included in the database.

### **What Happens When Detections are Reported to DPR**

When a pesticide is found in ground water, a well-defined process established by the PCPA is triggered. This process allows for comprehensive review of the detection.

DPR refers detections to SWRCB if the pesticide is: not currently registered for use; registered for other than agricultural, outdoor industrial, or outdoor institutional uses; or found in ground water and determined not to be due to legal agricultural use. (See Appendix E for definitions of terms used in this report.)



DPR attempts to verify the detection of pesticides that are currently registered for agricultural use by conducting a well sampling study. There are specific criteria for verification of a detection. If a detection is verified, a determination is made as to whether the contamination occurred because of legal agricultural use of the chemical. Detections may not be verified for one of several reasons, including:

Follow-up sampling has not yet been completed by DPR, or sampling was not conducted by DPR. The detection may have been referred to SWRCB; there may be no wells available for sampling; or permission to sample could not be obtained from the well owner.

Analyses of all other samples taken by DPR in response to the positive sample were negative for the compound under investigation.

### **General Information about Sampling Results in the Well Inventory Database**

A summary of the data in the database by report year is given in Table 1.

The data can be used to:

Display the geographic distribution of well sampling.

Display the geographic distribution of pesticide residues in sampled wells.

Identify areas potentially sensitive to contamination by the legal agricultural use of pesticides.

There are limitations on interpreting the data, including:

The data indicate which pesticides are present in well water among those pesticides for which analyses were performed. They do not represent a complete survey of ground water quality throughout the State nor do they represent sampling for all pesticides.

Sampling by agencies other than DPR is not necessarily related to suspected agricultural sources of contamination.

### **The Data in this Report**

This is the twelfth report and the fifth update to the 1992 cumulative report on the entire contents of the database.

Data were submitted to DPR from July 1, 1996 to June 30, 1997.

Data are the results of 28 studies conducted by 9 agencies.

Data are from studies that were conducted from 1989 to 1997.



Table 1. Summary of well sampling results included in the Department of Pesticide Regulation's (DPR) well inventory database, by report year.

CATEGORY	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL (d)
Total <b>wells</b> sampled	8987	574	3074	752	2784	1557	4741	2324	2839	3322	3564	2508	20,400
no detections	6583	317	2791	543	2550	1351	3985	1945	2414	2769	3128	2071	16,031
detections (a)	2404	257	283	209	234	206	756	379	425	552	436	437	4,369
verified detections (b)	44	29	4	140	93	133	67	80	37	213	6	96	855
Total <b>counties</b> sampled	53	20	41	33	53	30	52	46	50	47	48	48	58
no detections	30	6	24	11	27	11	24	25	30	19	20	24	10
detections (a)	23	14	17	22	26	19	28	21	20	28	28	24	48
verified detections (b)	5	3	3	16	8	14	9	17	10	17	5	7	32
Total <b>pesticides</b> and related compounds	160	79	167	96	191	186	125	112	114	166	121	165	308
no detections	144	64	142	81	164	166	85	83	95	139	99	143	212
detections (a)	16	15	25	15	27	20	40	29	19	27	22	22	96
verified detections (b)	8	6	5	9	6	9	5	10	6	9	3	11	24
Pesticides and related compounds detected in ground water as the result of legal, agricultural use (c)	9	8	1	7	6	7	5	11	8	9	8	9 (e)	15 (f)

(a) Includes verified and unverified detections.

(b) Detections are designated as verified if residues are detected in one sample as a result of an analytical method approved by DPR and verified, within 30 days in a second discrete sample taken from the well, by a second analytical method or laboratory approved by DPR; or if an unequivocal detection is made.

(c) Legal, agricultural use is the application of a pesticide, according to its labeled directions and in accordance with all laws and regulations. Agricultural use is defined in Food and Agricultural Code section 11408.

(d) The total is not additive. A single well that had sampling data reported in the 1987, 1988, and 1990 reports is counted one time only.

(e) The 9 compounds are: 1,2-D, ACET\*, atrazine, bromacil, DBCP, deethyl-atrazine, diuron, EDB, and simazine.

(f) The 15 compounds are: 1,2-D, ACET, aldicarb, aldicarb sulfone, aldicarb sulfoxide, atrazine, bentazon, bromacil, DBCP, deethyl-atrazine, deisopropyl-atrazine, diuron, EDB, prometon, simazine, and 2,3,5,6-tetrachloroterephthalic acid. Aldicarb, atrazine, bentazon, bromacil, diuron, prometon, and simazine have been reviewed through the Pesticide Detection Response Process. DPR considers the remaining chemicals to have reached ground water as a result of legal, agricultural use.

\* Beginning with this report, when the parent compound is unknown, 2-amino-4-chloro-6-ethylamino-s-triazine (ACET) and 2,4-diamino-6-chloro-s-triazine (DACT) will be used to name the degradates common to both atrazine and simazine. Previously, either deisopropyl-atrazine or deethyl-simazine were used.





## **Summary of Data in This Report**

48,919 records (chemical analyses) were added to the database for this report.

2,508 wells were sampled in 48 counties.

165 pesticide active ingredients and breakdown products were analyzed.

22 compounds were reported with positive detections.

## **Detections Referred to SWRCB**

Detections of nine chemicals, including three chemicals where historical agricultural applications are considered by DPR to be the source of residues in ground water, were reported to SWRCB.

The three chemicals and the number of wells with detections are:

1,2-dibromo-3-chloropropane (DBCP): 276 wells

1,2-dichloropropane (1,2-D): 7 wells, and

ethylene dibromide (EDB): 18 wells.

## **Chemical names**

Deethyl-atrazine (2-amino-4-chloro-6-isopropylamino-s-triazine, DEA) is a degradate of atrazine. 2-amino-4-chloro-6-ethylamino-s-triazine (ACET) and 2,4-diamino-6-chloro-s-triazine (DACT) are breakdown products of either atrazine or simazine. Beginning with this report, when the parent compound is unknown, ACET and DACT will be used to name the degradates common to both atrazine and simazine. In previous reports, either deisopropyl-atrazine or deethyl-simazine were used in place of ACET.

## **Summary of Verified Detections**

Verified detections were made of 11 compounds: bromacil, diuron, hexazinone, norflurazon, prometon, TPA, atrazine and its breakdown product DEA, simazine, and the breakdown products ACET, DACT, which are common to both atrazine and simazine.

Verified detections were made in 96 wells in seven counties (Table 2).

Counties with verified detections were: Butte, Fresno, Madera, Mendocino, San Joaquin, Stanislaus, and Tulare.

Verified detections were made in 86 private drinking water wells, 7 public wells, and 3 non-drinking wells.

The concentration of all verified detections was below established health action levels for these compounds.



Table 2. Summary of wells with verified detections of pesticide residues by county and chemical. Results are for data reported from July 1, 1996 through June 30, 1997.

Chemical	Butte	Fresno	Madera	Mendocino	San Joaquin	Stanislaus	Tulare	Total Wells
atrazine	1	1			5			7
bromacil	1	16					11	28
diuron		33	2		2(a)	1	12	50
hexazinone					2(a)	1(a)		3
norflurazon(b)		8(a)					1(a)	9
prometon		1						1
simazine		47	3(a)	2(a)	1(a)		21	74
TPA			3(a)					3
ACET		21			3(a)	1	12	37
DACT(b)		22(a)					5(a)	27
DEA		26			6(a)		8	40
<b>Total</b>	<b>1</b>	<b>54</b>	<b>4</b>	<b>2</b>	<b>9</b>	<b>2</b>	<b>24</b>	<b>96</b>

(a) First time verified detection of this chemical in this county

(b) These are the first verified detections of DACT and norflurazon in California

### Legal Agricultural Use Determinations

After well sampling and land use surveys are completed, a determination is made as to whether the detection of the pesticide residues in ground water could have been due to legal agricultural use. Specific criteria must be met for this determination to be made.

Legal agricultural use was determined to be the source of residues in 45 wells in six counties (Section II, Table II-3). The pesticides and breakdown products are: atrazine, bromacil, diuron, prometon, simazine, ACET, DEA, and TPA

### Pesticide Management Zone (PMZ)

A PMZ is a land area where a pesticide has been detected in ground water and where it has been determined that the contamination was due to legal agricultural use. PMZs are established in regulation to prevent further contamination of ground water. The use of certain chemicals is prohibited or restricted in these areas. PMZs have been established in various areas of the State for atrazine, bromacil, diuron, prometon, and simazine.

DPR recommended 27 sections as new PMZs (Section II, Table II-4).

For the first time, two sections were recommended as PMZs for Madera County.



### **Factors That Contribute to Ground Water Contamination**

DPR environmental scientists continue their work to understand the factors that contribute to ground water contamination by pesticides used in agriculture. They conduct field studies on pesticide movement, investigate contaminated wells, compile extensive databases, and review the work of other scientists. The knowledge gained from these activities is used to develop pesticide use practices designed to prevent further ground water contamination. For the past several years, DPR scientists have been developing an approach that integrates climatic, soil, and geographic data in analyses of their combined influence on the movement of pesticides to ground water. This method may provide a basis for development of regional agricultural management practices to reduce ground water contamination by pesticides.

DPR conducted a cooperative study with the U. S. Geological Survey to investigate the ages and concentrations of herbicides in ground water in areas of Fresno and Tulare counties.

DPR continues a three-year program to prevent or eliminate additional herbicide residues from reaching ground water. In cooperation with the University of California Cooperative Extension, DPR works with growers, pest control advisors, the agricultural industry, and herbicide registrants to identify practical farm management alternatives that can reduce or prevent off-site movement of herbicides used in grape and citrus production.

### **The State and Regional Water Boards**

SWRCB and nine regional water quality control boards are responsible for protecting the beneficial uses of water in California and for controlling all discharges of waste into waters of the state. Actions taken by SWRCB to prevent pesticides from migrating to ground water are detailed in section III of this report.



## **PREFACE**

This report fulfills the requirements contained in section 13152, subdivision (e) of the Food and Agricultural Code, directing DPR to report specified information on sampling for pesticide residues in California ground water to the Legislature, CDHS, the Office of Environmental Health Hazard Assessment, and SWRCB annually by December 1.

This report presents data reported to DPR from July 1, 1996 through June 30, 1997. This is the twelfth report and the fifth update of the 1992 cumulative report (Maes *et al.*, 1992) which summarized ground water sampling results for agricultural use pesticides that were reported to DPR between November 1, 1983 and July 1, 1992.

The Pesticide Contamination Prevention Act (PCPA) requires that the annual report give the location of wells for which sampling results were reported. Although well locations are specified by township, range, and section in the database, listing results in this manner in the report is not possible due to the large number of wells sampled. Instead, sampling locations are summarized by county.

The information in this report is presented in three parts: Sections I, II, and III were written by DPR staff. Section III was written by SWRCB staff.

## **ACKNOWLEDGMENTS**

The authors wish to thank DPR staff Jeanine Van Pelt for data entry and verification and the reviewers whose unique perspectives helped ensure this report's accuracy and readability. In addition, we acknowledge the staff of cooperating federal, state, local, and private agencies for contributing their data, time, and efforts.

## **DISCLAIMER**

The mention of commercial products, their source, or their use, in this report is not to be construed as either an actual or implied endorsement of such product.





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## LIST OF ACRONYMS AND ABBREVIATIONS

AB 1803	Assembly Bill No. 1803 (Connelly, 1983), Health and Safety Code, sections 4026.2 and 4026.3
AB 2021	Assembly Bill No. 2021 (Connelly, 1985), Food and Agricultural Code, sections 13141 through 13152. Also known as the Pesticide Contamination Prevention Act.
ACET	2-amino-4-chloro-6-ethylamino-s-triazine
Cal/EPA	California Environmental Protection Agency
3CCR	Title 3, California Code of Regulations
CDHS	California Department of Health Services
1,2-D	1,2-dichloropropane; propylene dichloride
2,4-D	2,4-dichlorophenoxyacetic acid
DACT	2,4-diamino-6-chloro-s-triazine
DBCP	1,2-dibromo-3-chloropropane
DPR	Department of Pesticide Regulation
DWR	California Department of Water Resources
EDB	ethylene dibromide
EHAP	Environmental Hazards Assessment Program (Part of DPR)
EMPM	Environmental Monitoring and Pest Management Branch (DPR)
FAC	Food and Agricultural Code
GWPL	Groundwater Protection List
HAL	health advisory level
MCL	maximum contaminant level
MDL	minimum detection limit
PCA	pest control advisor
PCPA	Pesticide Contamination Prevention Act of 1985 (AB 2021)
PDRP	Pesticide Detection Response Process
PMZ	pesticide management zone
ppb	parts per billion
PREC	Pesticide Registration and Evaluation Committee
RWQCB	Regional Water Quality Control Board
SB 950	Senate Bill 950: The Birth Defect Prevention Act
SWRCB	State Water Resources Control Board
U.S. EPA	U. S. Environmental Protection Agency



## **I. WELL INVENTORY DATABASE**

### **INTRODUCTION**

This report presents results from California water wells sampled for pesticide residues. The Department of Pesticide Regulation (DPR) compiled the sampling results from July 1, 1996 through June 30, 1997. The report discusses actions taken to prevent pesticides from entering ground water by DPR and the State Water Resources Control Board (SWRCB), including the nine Regional Boards. Factors contributing to the movement of pesticides to ground water as a result of legal agricultural use are also presented.

### **BACKGROUND**

In 1979, the soil fumigant 1,2-dibromo-3-chloropropane (DBCP) was detected in ground water in Lathrop, California. These detections prompted widespread testing and many areas of DBCP contamination were found. Since then studies have been conducted throughout California to determine whether other pesticides have migrated to ground water.

On January 1, 1986, the Pesticide Contamination Prevention Act (PCPA) added sections 13141 through 13152 to Division 7 of the Food and Agricultural Code (FAC). The PCPA requires DPR to maintain a statewide database of wells sampled for pesticide active ingredients and to submit a report annually to the Legislature, the SWRCB, the California Department of Health Services (CDHS), and Cal/EPA's Office of Environmental Health Hazard Assessment. The report contains specific information from the database, as well as actions taken by the Director of DPR and the SWRCB to prevent pesticides from migrating to ground water.

In 1983, the Environmental Hazards Assessment Program (EHAP) of DPR developed the well inventory database to archive information on the occurrence of wells containing pesticide residues due to the agricultural use of pesticides. The well inventory is a unique archive of ground water sampling data for a single state. Although databases have been compiled in other states, only California centralizes monitoring results from various agencies.

The 1992 cumulative report (Maes, *et al.*, 1992) was the first to discuss the number of wells with detections resulting from the legal agricultural use of pesticides. Before 1992, well inventory reports emphasized the number of wells with confirmed, positive samples. In 1989, criteria were established for verifying detections of pesticide residues in ground water (Biermann, 1989). Reports after 1992 emphasize verified detections.



This is the twelfth annual report and the fifth update of the 1992 cumulative report. Section I summarizes the database by total wells sampled, verified detections, unverified detections, and the status of pesticides with verified detections. Section II describes the actions taken by DPR to prevent pesticides from entering ground water. Section III summarizes the actions taken by the SWRCB and the RWQCBs to prevent pesticides from migrating to ground water. Also included are a summary of the number of wells sampled by county and chemical (Appendix A), a summary of studies (Appendix B), criteria for verifying detections (Appendix C), the methods of data collection and format of records (Appendix D), and a glossary (Appendix E). A summary of data, by report year, is given in Table I-1.

### **CRITERIA FOR CLASSIFYING RECORDS IN THE WELL INVENTORY**

Each record in the well inventory database represents a well water sample analyzed for a pesticide residue. Each record was classified follows:

- (1) Well water samples were designated as ***negative*** if pesticide residues were not detected at or above the minimum detection limit (MDL) of the method used for analysis.
- (2) If pesticide residues were detected at or above the MDL, samples were classified into one of three categories:
  - (a) ***unconfirmed***: Pesticide residues were detected in only one sample during a single monitoring survey. Confirmation of the initial detection by a second positive sample was not possible because either only a single sample was taken from the well or analyses of all other samples taken from the well during the survey were negative.
  - (b) ***confirmed, unverified***: Pesticide residues were detected in two discrete samples taken from a well during a monitoring survey. A confirmed detection is unverified unless it meets the criteria of a verified detection.
  - (c) ***verified***: Confirmed detections are verified if they meet the criteria specified in FAC section 13149(d) of the PCPA. Section 13149(d) requires that the detection of a pesticide in ground water results either from an analytical method approved by the department that provides unequivocal identification of a chemical, or from verification within 30 days by a second analytical method or a second analytical laboratory approved by DPR. Criteria have been set by DPR for determining whether the detection of a pesticide or its breakdown product(s) in ground water meets the standards of section 13149(d) (Biermann, 1989, 1996; see Appendix C).



Table I-1. Summary of well sampling results included in the Department of Pesticide Regulation's (DPR) well inventory database, by report year, for data reported through June 30, 1997.

CATEGORY	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL <sup>(d)</sup>
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verified detections <sup>(b)</sup>	44	29	4	140	93	133	67	80	37	213	6	96	855
Total counties sampled	53	20	41	33	53	30	52	46	50	47	48	48	58
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detections <sup>(a)</sup>	23	14	17	22	26	19	28	21	20	28	28	24	48
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Total pesticides and related compounds	160	79	167	96	191	186	125	112	114	166	121	165	308
no detections	144	64	142	81	164	166	85	83	95	139	99	143	212
detections <sup>(a)</sup>	16	15	25	15	27	20	40	29	19	27	22	22	96
verified detections <sup>(b)</sup>	8	6	5	9	6	9	5	10	6	9	3	11	24
Pesticides and related compounds detected in ground water as the result of legal, agricultural use <sup>(c)</sup>	9	8	1	7	6	7	5	11	8	9	8	9 <sup>(e)</sup>	15 <sup>(f)</sup>

(a) Includes verified and unverified detections.

(b) Detections are designated as verified if residues are detected in one sample as a result of an analytical method approved by DPR and verified, within 30 days in a second discrete sample taken from the well, by a second analytical method or laboratory approved by DPR; or if an unequivocal detection is made.

(c) Legal, agricultural use is the application of a pesticide, according to its labeled directions and in accordance with all laws and regulations. Agricultural use is defined in Food and Agricultural Code section 11408.

(d) The total is not additive. A single well that had sampling data reported in the 1987, 1988, and 1990 reports is counted one time only.

(e) The 9 compounds are 1,2-D, ACET\*, atrazine, bromacil, DBCP, deethyl-atrazine, diuron, EDB, and simazine.

(f) The 15 compounds are 1,2-D, ACET, aldicarb, aldicarb sulfone, aldicarb sulfoxide, atrazine, bentazon, bromacil, DBCP, deethyl-atrazine, deisopropyl-atrazine, diuron, EDB, prometon, simazine, and 2,3,5,6-tetrachloroterephthalic acid. Aldicarb, atrazine, bentazon, bromacil, diuron, prometon, and simazine have been reviewed through the Pesticide Detection Response Process. DPR considers the remaining chemicals to have reached ground water as a result of legal, agricultural use.

\* Beginning with this report, when the parent compound is unknown, 2-amino-4-chloro-6-ethylamino-s-triazine (ACET) and 2,4-diamino-6-chloro-s-triazine (DACT) will be used to name the degradates common to both atrazine and simazine. Previously, either deisopropyl-atrazine or deethyl-simazine were used.





## **INTERPRETING THE DATA**

This report discusses data submitted to DPR from July 1, 1996 to June 30, 1997. The data are the results of 28 investigations, designed and conducted by nine agencies for varying purposes.

The information contained in the well inventory database can be used to:

- Design studies for future sampling.
- Display the geographic distribution of well sampling.
- Display the geographic distribution of pesticide residues in sampled wells.
- Identify areas potentially sensitive to contamination by the legal, agricultural use of pesticides.

Interpretation of sampling results in the well inventory database is subject to the following limitations:

The data indicate which pesticides are present in well water among those pesticides for which analyses were performed. They do not represent a complete survey of ground water quality throughout the State nor do they represent sampling for all pesticides used.

Sampling by agencies other than DPR is not necessarily related to the suspected presence of residues in ground water due to the agricultural use of pesticides. It should not be assumed that results submitted by those agencies are an indication of which pesticides are more or less likely to reach ground water as a result of agricultural use.

## **SUMMARY OF DATA**

### **RESULTS BY REPORTING AGENCY**

The results of 27 well sampling surveys were added to the well inventory database from July 1, 1996 through June 30, 1997. The surveys were conducted from 1989 through 1997. The data represent a total of 2,508 wells in 48 counties that were sampled for 165 pesticide active ingredients and breakdown products. A summary of the data included in the database, by sampling agency, is shown in Table I-2. Some wells were sampled by more than one agency. A summary of each study is presented in Appendix B.

Of the 2,508 wells sampled, 2,210 (88%) were public drinking water wells, 235 (9%) were private drinking water wells, 57 (2%) were non-drinking water wells, and 6 wells were either unused or the use was unknown.



Table I-2. Summary of records added to the Department of Pesticide Regulation's well inventory database, by agency, for the reporting period July 1, 1996 through June 30, 1997.

Sampling agency	Wells	Counties	Chemicals analyzed	Samples with Detections	Wells with detections	Records added to database
CDHS	2,204	43	109	1,256	309	42,047
DPR	179	12	16	375	96	2,045
Department of Water Resources	46	3	103	0	0	3,062
Ciba-Geigy	27	2	6	72	20	184
Santa Clara Co. Water District	20	1	22	0	0	576
City of San Francisco	11	1	26	0	0	319
Regional Water Quality Control Board- San Francisco Bay	9	1	68	13	8	633
Stockton - East San Joaquin Water Conservation District	8	1	4	3	3	40
U.S. Forest Service	6	4	1	2	1	13

## RESULTS BY PESTICIDE AND COUNTY

### Sampling Distribution

Sampling results for 165 pesticide active ingredients and breakdown products were reported. The most frequently sampled pesticides, DBCP and EDB, were each analyzed for in over 1,300 wells. Additionally, 13 chemicals were each sampled for in more than 1,000 wells. A list of the compounds by total number of counties and wells sampled, and number of wells with unverified and verified detections, is given in Table I-3.

Sampling results were reported for 48 of California's 58 counties (Table I-4). The number of pesticides analyzed in each county ranged from 1 (Mariposa) to 88 (Kern) (Table I-5). The number of wells sampled in each county ranged from 1 (Colusa, Lake, Marin, Mariposa) to 569 (Los Angeles). Variations in the number of wells sampled is due primarily to the differences in study design and sampling programs of the sampling agencies.

The 24 counties with detections and the 24 counties without detections are listed in Table I-4. A summary, by county, of pesticides analyzed and number of wells sampled versus number of wells with unverified, verified, and negative detections is given in Table I-5. A summary of the number of wells sampled and the number of wells with positive detections, by county and chemical, is given in Appendix A.



Table I-3. Pesticide active ingredients and breakdown products with analytical results added to the well inventory database for the 1997 report year, by total number of counties and wells sampled and number of wells with verified and unverified detections. Most wells were sampled for more than one compound. Results are for data reported from July 1, 1996 through June 30, 1997.

CHEMICAL	Number of Counties Sampled	Number of Wells Sampled	Wells with Unverified Detections	Wells with Verified Detections
1,3-DICHLOROPROPENE (1,3-D; TELONE)	9	258		
1,1,2,2-TETRACHLOROETHANE	35	1136		
1,2,4-TRICHLOROBENZENE	33	1086		
1,2-D + 1,3-D + C-3 COMPOUNDS	31	1047		
1,2-DICHLOROPROPANE (1,2-D)	36	1145	7	
1,4-DICHLOROBENZENE (P-DCB)	2	13		
2,3,7,8-TCDD (DIOXIN)	4	9		
2,4,5-T	8	55		
2,4,5-TP (SILVEX)	30	426		
2,4,6-TRICHLOROPHENOL	1	1		
2,4-D	30	452		
2,4-DINITROPHENOL	1	1		
3-HYDROXYCARBOFURAN	26	294		
4(2,4-DB), BUTOXYETHANOL ESTER	1	20		
4(2,4-DB), DIMETHYLAMINE SALT	1	2		
ACENAPTHENE	3	24		
ACEPHATE	1	33		
ACET	11	155	18	37
ALACHLOR	26	524		
ALDICARB	26	297		
ALDICARB SULFONE	26	296		
ALDICARB SULFOXIDE	26	296		
ALDRIN	29	390		
AMETRYNE	2	35		
AMINOCARB	1	9		
AROCLOR	3	33		
ATRATON	2	35		
ATRAZINE	36	802		7
AZINPHOS-METHYL (GUTHION)	2	42		
BARBAN	1	9		
BENEFIN (BENFLURALIN)	1	5		
BENTAZON, SODIUM SALT	28	374	1	
BENZENE (BENZOL)	35	1137	11	
BHC (OTHER THAN GAMMA ISOMER)	6	89		
BIS(2-ETHYLHEXYL)PHTHALATE	2	13		
BROMACIL	34	767		28
BUTACHLOR	30	505		



Table I-3 continued.

CHEMICAL	Number of Counties Sampled	Number of Wells Sampled	Wells with Unverified Detections	Wells with Verified Detections
BUTYLATE	1	2		
CAPTAN	1	5		
CARBARYL	27	418		
CARBOFURAN	29	401		
CARBON TETRACHLORIDE	2	13		
CARBOPHENOTHION	1	5		
CHLORDANE	31	469		
CHLOROMETHANE (METHYL CHLORIDE)	34	1103	5	
CHLOROPICRIN	3	46		
CHLOROTHALONIL	26	333		
CHLORPROPHAM	2	11		
CHLORPYRIFOS	2	42		
CHLORTHAL-DIMETHYL (DACTHAL)	3	10		
CHLORTHAL-DIMETHYL ACID METABOLITES	1	33		
COUMAPHOS	2	42		
CYANAZINE	12	149		
CYCLOATE	1	2		
DALAPON	28	411		
DBCP	28	1366	276	
DDD	5	56		
DDE	5	56		
DDT	5	56		
DDVP (DICHLORVOS)	3	44		
DEETHYL-ATRAZINE	11	158		40
DEETHYLHYDROXYSIMAZINE	2	27		
DEMETON	5	54		
DEMETON-S-METHYL	1	9		
DIAMINOCHLOROTRIAZINE (DACT)	2	57	20	27
DIAMINOHYDROXYTRIAZINE	2	27		
DIAZINON	34	607		
DICAMBA	26	325		
DICHLORPROP	1	9		
DICOFOL	1	5		
DIELDRIN	26	384		
DIMETHOATE	31	542		
DINOSEB	29	409		
DIPHENAMID	1	2		
DIQUAT DIBROMIDE	25	327		
DISULFOTON	6	63		





Table I-3 continued.

CHEMICAL	Number of Counties Sampled	Number of Wells Sampled	Wells with Unverified Detections	Wells with Verified Detections
DIURON	30	522		50
DMPA (ZYTRON)	1	5		
ENDOSULFAN	6	89		
ENDOSULFAN II	3	64		
ENDOSULFAN SULFATE	6	89		
ENDOTHALL	24	175		
ENDRIN	31	441		
ENDRIN ALDEHYDE	6	89		
ENDRIN KETONE	1	11		
EPTC	1	2		
ETHION	1	33		
ETHOPROP (PROPHOS)	2	42		
ETHYLENE DIBROMIDE	30	1342	18	
ETHYLENE DICHLORIDE	2	13		
FENAMIPHOS	2	35		
FENSULFOTHION	2	42		
FENTHION	2	42		
FENURON	1	9		
FLUOMETURON	1	9		
FORMETANATE HYDROCHLORIDE	2	13		
GLYPHOSATE, ISOPROPYLAMINE SALT	20	249		
HEPTACHLOR	31	449		
HEPTACHLOR EPOXIDE	31	450		
HEXACHLOROBENZENE	28	352		
HEXAZINONE	15	157	1	3
HYDROXYSIMAZINE	2	27		
LINDANE (GAMMA-BHC)	31	448		
LINURON	1	9		
MALATHION	2	83		
MCPP (2-(4-CHLORO-2-METHYLPHENOXY)PROPIONIC ACID)	1	9		
MERPHOS	2	11		
METHIOCARB	7	45		
METHOMYL	29	338		
METHOXYCHLOR	32	404		
METHYL BROMIDE (BROMOMETHANE)	35	1109	8	
METHYL CHLOROFORM (1,1,1-TRICHLOROETHANE)	3	22		
METHYL CHLORPYRIFOS	1	33		
METHYL PARATHION	3	92		



Table I-3 continued.

CHEMICAL	Number of Counties Sampled	Number of Wells Sampled	Wells with Unverified Detections	Wells with Verified Detections
METHYLENE CHLORIDE	4	55	5	
METOLACHLOR	30	502		
METRIBUZIN	32	651		
MEVINPHOS (PHOSDRIN)	3	47		
MEXACARBATE	2	42		
MOLINATE	32	585		
MONURON	1	9		
MTP (MONOMETHYL 2,3,5,6-TETRACHLOROTEREPHTHALATE)	1	6		
NALED	2	42		
NAPHTHALENE	31	1199	1	
NAPROPAMIDE	1	2		
NEBURON	1	9		
NITROFEN	1	5		
NORFLURAZON	7	85		9
ORTHO-DICHLOROBENZENE	35	1135		
ORTHO-DICHLOROBENZENE, OTHER RELATED	2	42		
OXAMYL	28	432		
PARAQUAT DICHLORIDE	4	25		
PARATHION OR ETHYL PARATHION	2	83		
PENDIMETHALIN	1	5		
PENTACHLORONITROBENZENE (PCNB)	1	5		
PENTACHLOROPHENOL (PCP)	2	13		
PHORATE	2	42		
PICLORAM	28	404		
PROMETON	14	157		1
PROMETRYN	33	673		
PROPACHLOR	27	385		
PROPAZINE	1	2		
PROPHAM	2	42		
PROPOXUR	6	65		
PROTHIOFOS	2	42		
RONNEL	2	42		
SIDURON	1	9		
SIMAZINE	37	851	15	74
SIMETRYN	2	7		
SULPROFOS	2	42		
SWEP (3,4-DICHLOROCARBANILATE)	2	42		



Table I-3 continued.

CHEMICAL	Number of Counties Sampled	Number of Wells Sampled	Wells with Unverified Detections	Wells with Verified Detections
TEBUTHIURON	1	2		
TERBUTRYN	2	7		
TETRACHLORVINPHOS (STIROFOS)	3	44		
THIOBENCARB	29	560		
TOLUENE	2	13		
TOXAPHENE	31	432		
TPA (2,3,5,6-TETRACHLOROTEREPHTHALIC ACID)	1	6		3
TRIADIMEFON	1	2		
TRICHLOROBENZENES	32	1048	1	
TRICHLORONATE	2	42		
TRIFLURALIN	1	3		
VERNOLATE	1	2		
XYLENE	32	1150	13	
ZIRAM	2	13		
TOTAL	48	2508	343	96

Table I-4. Counties with and without detections of pesticides or related compounds for data reported during the period July 1, 1996 through June 30, 1997.

**Counties without detections**

Alameda	Placer
Amador	Plumas
Colusa	San Diego
Contra Costa	San Francisco
El Dorado	San Luis Obispo
Glenn	Santa Barbara
Humboldt	Santa Clara
Inyo	Siskiyou
Marin	Sutter
Mariposa	Tehama
Modoc	Tuolumne
Orange	Yolo

**Counties with detections**

Butte *	Riverside
Calaveras	Sacramento
Fresno *	San Bernardino
Kern	San Joaquin *
Kings	San Mateo
Lake	Santa Cruz
Los Angeles	Solano
Madera *	Sonoma
Mendocino *	Stanislaus *
Merced	Tulare *
Monterey	Ventura
Napa	Yuba

\* counties with verified detections. Verified detections are discussed beginning on page 12.



Table I-5. Summary, by county, of total number of pesticides and wells sampled versus wells with unverified, verified, and negative detections. Wells may have both unverified and verified detections. Results are for data reported from July 1, 1996 through June 30, 1997.

County	Total Pesticides Sampled	Total Wells Sampled	Wells with Unverified Detections	Wells with Verified Detections	Wells with No Detections
Alameda	8	5			5
Amador	23	2			2
Butte	34	14		1	13
Calaveras	16	7	1		6
Colusa	9	1			1
Contra Costa	56	6			6
El Dorado	11	28			28
Fresno	70	367	121	54	192
Glenn	14	9			9
Humboldt	70	34			34
Inyo	11	4			4
Kern	88	93	10		83
Kings	11	1	1		0
Lake	37	15	1		14
Los Angeles	70	569	23		546
Madera	52	16	4	4	10
Marin	10	1			1
Mariposa	1	1			1
Mendocino	32	14		2	12
Merced	61	45	15		30
Modoc	68	4			4
Monterey	61	20	1		19
Napa	68	9	8		1
Orange	71	186			186
Placer	11	3			3
Plumas	3	2			2
Riverside	56	89	18		71
Sacramento	57	40	1		39
San Bernardino	58	307	58		249
San Diego	57	4			4
San Francisco	26	11			11
San Joaquin	63	119	23	9	87
San Luis Obispo	56	38			38
San Mateo	48	5	3		2
Santa Barbara	56	44			44
Santa Clara	65	71			71
Santa Cruz	10	3	1		2
Siskiyou	68	9			9
Solano	43	10	1		9
Sonoma	55	25	1		24
Stanislaus	62	48	6	2	40
Sutter	23	8			8
Tehama	22	7			7
Tulare	68	156	43	24	89
Tuolumne	2	3			3
Ventura	56	32	1		31
Yolo	57	13			13
Yuba	18	10	2		8
Total	165	2508	343	96	2072





## WELLS AND COUNTIES WITH VERIFIED DETECTIONS

Verified detections were made in a total of 96 wells in 7 counties. Verified detections were made in 86 private drinking water wells, 7 public wells, and 3 non-drinking wells. Overall, 11 compounds were found in the 96 wells with verified detections. A summary of wells with verified detections, by county and pesticide, is given in Table I-6.

Table I-6. Summary of wells with verified detections of pesticide residues, by county and chemical. Results are for data reported from July 1, 1996 through June 30, 1997.

Chemical	Butte	Fresno	Madera	Mendocino	San Joaquin	Stanislaus	Tulare	Total Wells
atrazine	1	1			5			7
bromacil	1	16					11	28
diuron		33	2		2(a)	1	12	50
hexazinone					2(a)	1(a)		3
norflurazon <sup>(b)</sup>		8(a)					1(a)	9
prometon		1						1
simazine		47	3(a)	2(a)	1(a)		21	74
TPA			3(a)					3
ACET		21			3(a)	1	12	37
DACT <sup>(b)</sup>		22(a)					5(a)	27
DEA		26			6(a)		8	40
<b>Total</b>	<b>1</b>	<b>54</b>	<b>4</b>	<b>2</b>	<b>9</b>	<b>2</b>	<b>24</b>	<b>96</b>

(a) First time verified detection of this chemical in this county

(b) These are the first verified detections of DACT and norflurazon in California

## COUNTIES WITH FIRST-TIME VERIFIED DETECTIONS

The counties with a first-time verified detection of a pesticide that has previously been found in other areas of California are noted in Table I-6. Also noted are the first verified detections of DACT and norflurazon in Fresno and Tulare counties. These are the first verified detections of DACT and norflurazon in California ground water.

## STATUS OF PESTICIDES WITH VERIFIED DETECTIONS

### Atrazine

For use reported in 1995, 69% of the total 36,201 pounds applied was accounted for in forage-fodder crops. Other sites of major use of this herbicide included forest lands, rights-of-way, and corn for human consumption (DPR, 1995). Atrazine was reviewed through the Pesticide Detection Response Process (PDRP), including review by a subcommittee of the Pesticide



Registration and Evaluation Committee (PREC), pursuant to FAC sections 13149 through 13151. DPR adopted regulations that prohibit the use of pesticides containing atrazine within an atrazine Pesticide Management Zone (PMZ). A PMZ is a geographic surveying unit of approximately one square mile (a section) that is designated in regulation as sensitive to ground water pollution.

Detections of atrazine residues were verified in 7 wells in 3 counties out of 802 wells sampled in 36 counties. Concentrations of verified detections ranged from 0.065 to 2.8 ppb. The CDHS and U. S. EPA maximum contaminant level (MCL, see glossary) for atrazine is 3 ppb.

### **Bromacil**

For use reported in 1995, 75% of the total 96,772 pounds used was accounted for in citrus and 19% for right-of-way uses. Bromacil, an herbicide, was reviewed through the PDRP, including review by a subcommittee of the PREC. DPR adopted regulations that prohibit the agricultural, outdoor institutional, or outdoor industrial uses of bromacil in non-crop areas and on rights-of-way within bromacil PMZs. Bromacil was also made a restricted material for which a permit is required for crop uses in bromacil PMZs. The permit can only be issued if growers submit a ground water protection advisory written by a licensed pest control adviser (PCA) who has completed an approved ground water protection course within the previous two years.

Bromacil residues were verified in 28 wells in 3 counties out of 767 wells sampled in 34 counties. Concentrations of verified detections ranged from 0.051 to 3.2 ppb. No MCL has been established for bromacil. The U. S. EPA Integrated Risk Information Reference Dose (IRIS RfD, see glossary) for bromacil is 91 ppb.

### **Diuron**

For use reported in 1995, 47% of the total 1,073,681 pounds used was accounted for in right-of-way uses and 23% in citrus. Diuron, an herbicide, was reviewed through the PDRP, including review by a subcommittee of the PREC. DPR adopted regulations that prohibit the agricultural, outdoor institutional, or outdoor industrial uses of diuron in non-crop areas and on rights-of-way within diuron PMZs. Diuron was also made a restricted material for which a permit is required for crop uses in diuron PMZs. The permit can only be issued if growers submit a ground water protection advisory written by a licensed PCA who has completed an approved ground water protection course within the previous two years.



Diuron residues were verified in 50 wells in 5 counties out of 522 wells sampled in 30 counties. Concentrations of verified detections ranged from 0.052 to 1.5 ppb. No MCL has been established for diuron. The U. S. EPA IRIS RfD for diuron is 10 ppb.

### **Hexazinone**

Hexazinone is an herbicide. For use reported in 1995, 53% of the total 102,101 pounds used was on alfalfa and 46% in forest lands. Hexazinone residues were verified in 3 wells in 2 counties out of 157 wells in 15 counties. Concentrations of verified detections ranged from 0.063 ppb to 0.27 ppb. No MCL has been established for hexazinone. The U. S. EPA IRIS RfD for hexazinone is 230 ppb.

After evaluating the evidence, DPR determined that the residues in both wells in San Joaquin County did not meet the criteria of section 13149(2) of the FAC (“that an active ingredient has been found in the groundwaters of the State”), and were not a result of legal agricultural use. It was also recommended that the Environmental Monitoring and Pest Management Branch continue to monitor for hexazinone.

### **Norflurazon**

For use reported in 1995, 56% of the total 153,678 pounds used was accounted for in various fruit and nut crops, and 32% was used in grapes and citrus. The verified norflurazon detections in Fresno County presented evidence that the herbicide norflurazon should continue in the AB 2021 detections response process.

Norflurazon residues were verified in 9 wells in 2 counties out of 85 wells in 7 counties. Concentrations of verified detections ranged from 0.072 ppb to 0.79 ppb. No MCL has been established for norflurazon.

### **Prometon**

For use reported in 1995, 52% of the total 117 pounds used was in landscape maintenance, and 38% was on rights-of-way. Prometon, an herbicide, was reviewed through the PDRP, including review by a subcommittee of the PREC. DPR adopted regulations that prohibit the agricultural, outdoor institutional, or outdoor industrial uses of prometon in non-crop areas and on rights-of-way within prometon PMZs.

Prometon residues were verified in 1 well in Fresno County out of 157 wells in 14 counties. The concentration detected was 0.27 ppb. The U.S. EPA IRIS RfD for prometon is 110 ppb.



## **Simazine**

For use reported in 1995, 78% of the total 842,712 pounds was applied to grape, citrus, and fruit and nut crops, and 16% on rights-of-way. Simazine, an herbicide, was reviewed through the PDRP, including review by a subcommittee of the PREC. DPR adopted regulations that prohibit the agricultural, outdoor industrial, or outdoor institutional use of pesticides containing simazine in non-crop areas or on rights-of-way within simazine PMZs. Simazine was also made a restricted material for which a permit is required for crop uses in simazine PMZs. The permit can only be issued if growers submit a ground water protection advisory written by a licensed pest control adviser (PCA) who has completed an approved ground water protection course within the previous two years.

Simazine residues were verified in 74 wells in 5 counties out of 851 wells sampled in 37 counties. Concentrations of verified detections ranged from 0.05 to 0.93 ppb. Both the CDHS and U. S. EPA MCL for simazine is 4 ppb.

## **TPA**

TPA (2,3,5,6-tetrachloroterephthalic acid) is a breakdown product of the herbicide chlorthal-dimethyl. Use in broccoli and onions accounted for 70% of the total 575,820 pounds applied. Verified detections were made in 3 wells in Madera County, and the concentration of verified detections ranged from 0.419 ppb to 0.889 ppb. Although no MCL has been set for TPA, the U.S. EPA IRIS RfD for its parent compound chlorthal-dimethyl is 3500 ppb.

## **Triazine breakdown products: ACET, DACT, DEA.**

Deethyl-atrazine (2-amino-4-chloro-6-isopropylamino-s-triazine, DEA) is a degradate of atrazine. 2-amino-4-chloro-6-ethylamino-s-triazine (ACET) and 2,4-diamino-6-chloro-s-triazine (DACT) are breakdown products of either atrazine or simazine. Beginning with this report, when the parent compound is unknown, ACET and DACT will be used to name the degradates common to both atrazine and simazine. In previous reports, either deisopropyl-atrazine or deethyl-simazine were used in place of ACET. This is the first year that sampling data for DACT has been entered into the database. Concentrations of verified detections ranged from 0.053 ppb to 1.4 ppb for ACET, 0.054 to 0.93 ppb for DACT, and 0.059 ppb to 3.2 ppb for DEA.





## **SUMMARY OF UNVERIFIED DETECTIONS**

Samples with unverified detections are reviewed or investigated in one of two ways. Detections of the following are referred to the SWRCB: pesticides that are not currently registered for use, pesticides registered for other than agricultural, outdoor industrial, or outdoor institutional uses, and pesticides in ground water which are determined not to be the result of legal agricultural use. The SWRCB and nine RWQCBs are responsible for protecting the beneficial uses of water in California and for controlling all discharges of waste into waters of the State. Compounds registered for agricultural use in California are investigated by DPR. The investigation of the initial detection may lead to other verified detections, or all subsequent samples may be negative for pesticide residues. Negative follow-up samples may result from delays (sometimes years) in reporting the initial detection to DPR.

A summary of the status of all positive samples (verified and unverified) added to the database for this report is given in Table I-7. Of the 48,919 records added to the well inventory for this report, there were 1,348 (2.8%) unverified detections from 343 wells in 22 counties for a total of 16 pesticide active ingredients or breakdown products.

Of the 1,348 unverified samples, 1,262 (94%) were for chemicals currently not registered or not registered for agricultural use. The chemicals were 1,2-dichloropropane, benzene, chloromethane, DBCP, ethylene dibromide, methylene chloride, naphthalene, unspecified trichlorobenzenes, and xylene. These detections have been reported to the SWRCB.

Reported unverified detections of 7 compounds, which are contained in, or are breakdown products of, pesticides registered for agricultural use, were investigated by DPR: bentazon, ACET, DACT, hexazinone, methyl bromide, simazine, and TPA. The results of these investigations are described in Table I-7.



Table I-7. Status, as of June 30, 1997, of all reported detections of pesticide active ingredients and breakdown products in ground water that were added to the Department of Pesticide Regulation (DPR) well inventory database from July 1, 1996 through June 30, 1997.

Compound Detected	Number of Counties and Wells Sampled	Counties and Number of Wells with Detections	Range of Concentrations Detected (ppb)	Water Quality Criteria (a)	Registration Status Type of Compound Comments
1,2-dichloropropane (1,2-D; propylene dichloride)	36 counties 1145 wells	Fresno, 1 Kern, 1 Riverside, 1 San Mateo, 2 Sonoma, 1 Tulare, 1	0.5 - 7.5	DHS & USEPA MCL: 5	Fumigant. Not registered (NR). Source of residues was determined by DPR to be due to historical non-point source, legal agricultural use. Regulations were adopted in 1985 that prohibit the use or sale of pesticides in California in which 1,2-D exceeds 0.5% of the total formulation. Referred to SWRCB.
ACET (2-amino-4-chloro-6-ethylamino-s-triazine)	11 counties 155 wells	Fresno, 28 San Joaquin, 3 Stanislaus, 1 Tulare, 23	0.053 - 3.8		Breakdown product of atrazine or simazine. Sources of residues in wells in the following counties were determined by DPR to be due to non-point source legal agricultural use: Fresno, 15, San Joaquin, 2; Tulare, 4. Detections that are CUI by DPR: Fresno, 1; San Joaquin, 1; Tulare, 1. No further action will be taken for the following wells: Fresno, 12; Tulare, 18; Stanislaus, 1.
atrazine	36 counties 802 wells	Butte, 1 Fresno, 1 San Joaquin, 5	0.65 - 2.8	DHS & USEPA MCL 3	Herbicide. Active registration (AR). Sources of residues in all wells were determined by DPR to be due to non-point source legal agricultural use.
bentazon, sodium salt	28 counties 374 wells	Yuba, 1	2.3 - 2.9	DHS MCL 18	Herbicide. AR. Detection was determined to be due to historical legal agricultural use. No further action will be taken.

(a) Marshack, J.B. A Compilation of Water Quality Goals. and personal communication. Definitions of the various Water Quality Criteria are given below.

DHS MCL: Maximum Contaminant Level (MCL) adopted by DHS under the Safe Drinking Water Act. MCLs are formally established in regulation and are enforceable by DHS on water suppliers. Values are expressed in ppb.

USEPA IRIS RfD: USEPA Integrated Risk Information System (IRIS) Reference Dose (RfD): published by USEPA's Office of Water. See glossary for complete description. Values are expressed in mg/kg/day.

USEPA MCL: MCL adopted by the U.S. Environmental Protection Agency (USEPA) under the Safe Drinking Water Act. MCLs are enforceable by the California Department of Health Services (DHS) on water suppliers. Values are expressed in ppb.



Table I-7 continued

Compound Detected	Number of Counties and Wells Sampled	Counties and Number of Wells with Detections	Range of Concentrations Detected (ppb)	Water Quality Criteria (a)	Registration Status Type of Compound Comments
benzene	35 counties 1137 wells	Kern, 1 Kings, 1 Lake, 1 Los Angeles, 3 Sacramento, 1 Santa Cruz, 1 Solano, 1 Sonoma, 1 Yuba, 1	0.25 - 5.7	DHS MCL 1  USEPA MCL 5	Benzene was an ingredient in some early grain fumigants. NR for agricultural use. Referred to SWRCB.
bromacil	34 counties 767 wells	Butte, 1 Fresno, 16 Tulare, 11	0.051 - 3.2	USEPA IRIS RfD 91	Herbicide. AR. Sources of residues were determined by DPR to be due to non-point source legal agricultural use: 1 well in Butte, 3 wells in Fresno, 4 wells in Tulare. Sources of residues that are currently under investigation (CUI) by DPR are: 11 wells in Fresno and 3 wells in Tulare. No investigation will be conducted for the remaining 2 wells in Fresno and 4 wells in Tulare because they are in or adjacent to a proposed or existing pesticide management zone (PMZ).
chloromethane	34 counties 1103 wells	Los Angeles, 1 Merced, 1 Monterey, 1 San Bernardino, 2	0.6 - 4.7	USEPA IRIS RfD 2.8	Fumigant. NR. Referred to SWRCB.
DBCP (1,2-dibromo-3-chloropropane)	28 counties 1366 wells	Fresno, 113 Kern, 7 Los Angeles, 12 Madera, 2 Merced, 13 Riverside, 16 San Bernardino, 57 San Joaquin, 23 Stanislaus, 5 Tulare, 28	0.01 - 6.29	DHS & USEPA MCL 0.2	Soil fumigant. NR. Use suspended in 1979. Source of residues considered by DPR to be from historical non-point source, legal agricultural use. Referred to SWRCB.



Table I-7 continued

Compound Detected	Number of Counties and Wells Sampled	Counties and Number of Wells with Detections	Range of Concentrations Detected (ppb)	Water Quality Criteria (a)	Registration Status Type of Compound Comments
deethyl-atrazine	11 counties 158 wells	Fresno, 26 San Joaquin, 6 Tulare, 8	0.059 - 3.2		Breakdown product of atrazine. Sources of residues in wells in the following counties were determined by DPR to be due to non-point source legal agricultural use: Fresno, 2; San Joaquin, 5; Tulare, 2. Detections in 24 wells in Fresno, 1 well in San Joaquin, and 6 wells in Tulare are CUI by DPR.
diaminochlorotriazine (DACT)	2 counties 57 wells	Fresno, 29 Tulare, 18	0.054 - 6.9		Breakdown product of atrazine or simazine. Detections that are CUI by DPR: Fresno, 22; Tulare, 5. No further action will be taken: Fresno, 7; Tulare, 13.
diuron	30 counties 522 wells	Fresno, 33 Madera, 2 San Joaquin, 2 Stanislaus, 1 Tulare, 12	0.052 - 1.5	USEPA IRIS RfD 14	Herbicide. AR. Sources of residues in wells in the following counties were determined by DPR to be due to non-point source legal agricultural use: Fresno, 15; Madera, 2; San Joaquin, 2; Tulare, 2. Detections in 14 wells in Fresno and 5 wells in Tulare are CUI by DPR. No further action will be taken on detections in 4 wells in Fresno and 5 wells in Tulare because the detections are in or adjacent to a proposed or existing PMZ. Sampling in Stanislaus found no other residues of diuron and no further action will be taken.
ethylene dibromide (EDB)	30 counties 1342 wells	Fresno, 7 Kern, 2 Los Angeles, 1 Madera, 1 Merced, 3 Riverside, 2 San Joaquin, 1 Stanislaus, 1	0.02 - 0.87	DHS & USEPA MCL 0.05	Fumigant, insecticide, nematicide. NR since 1/87. Source of residues considered by DPR to be from historical non-point source, legal agricultural use. Referred to SWRCB.





Table I-7 continued

Compound Detected	Number of Counties and Wells Sampled	Counties and Number of Wells with Detections	Range of Concentrations Detected (ppb)	Water Quality Criteria (a)	Registration Status Type of Compound Comments
hexazinone	15 counties 157 wells	Calaveras, 1 San Joaquin, 2 Stanislaus, 1	0.063 - 0.27	USEPA IRIS RfD 230	Herbicide. AR. Wells in Calaveras and Stanislaus counties were non-detect during follow-up studies conducted by DPR. DPR determined that the sources of residues in both wells in San Joaquin County were transient and did not meet the criteria of section 13149(2) of the FAC ("that an active ingredient has been found in the groundwaters of the State") and are not due to legal agricultural use.
methyl bromide	35 counties 1109 wells	Napa, 8	0.6 - 0.7	IRIS RfD 7	Fumigant. AR. All wells were non-detect during follow-up studies conducted by DPR. The results from the DPR follow-up studies were reported in the 1996 update report.
methylene chloride	4 counties 55 wells	Napa, 5	3.0 - 6.0		Fumigant. NR. Referred to SWRCB.
naphthalene	31 counties 1199 wells	Fresno, 1	0.52	USEPA IRIS RfD 28	Fumigant, insecticide. NR for agricultural use. Referred to SWRCB.
norflurazon	7 counties 85 wells	Fresno, 8 Tulare, 1	0.072 - 0.79		Herbicide. AR. Norflurazon was not detected during sampling conducted by DPR for follow-up for the well in Tulare County. Sources of residues in 8 wells in Fresno County are CUI by DPR
prometon	14 counties 157 wells	Fresno, 1	0.27		Herbicide. AR. Source of residues was determined by DPR to be due to non-point source legal agricultural use.
simazine	37 counties 851 wells	Fresno, 54 Madera, 3 Mendocino, 2 San Joaquin, 1 Tulare, 29	0.05 - 0.93	DHS & USEPA MCL 4	Herbicide. AR. Sources of residues in wells in the following counties were determined by DPR to be due to non-point source legal agricultural use: Fresno, 13; Madera, 3; Mendocino, 2; San Joaquin, 1; Tulare, 7. Detections that are CUI by DPR: Fresno, 25; Tulare, 8. No further action will be taken for the following detections: Fresno, 7; Tulare, 8.



Table I-7 continued

Compound Detected	Number of Counties and Wells Sampled	Counties and Number of Wells with Detections	Range of Concentrations Detected (ppb)	Water Quality Criteria (a)	Registration Status Type of Compound Comments
TPA	1 county 6 wells	Madera, 3	0.419 - 1.5	IRIS RfD 3500	Breakdown product of chlorthal dimethyl, an actively registered herbicide. Sources of residues in these wells were determined by DPR to be due to non-point source legal agricultural use. The Medical Toxicology Branch of DPR concluded that, at the levels detected in ground water, TPA does not pose a threat to public health. TPA will not be submitted into the AB2021 detection response process.
trichlorobenzenes	32 counties 1048 wells	San Mateo, 1	3.9	DHS & USEPA MCL 70	NR for agricultural use. Referred to SWRCB.
xylene	32 counties 1150 wells	Kern, 1 Lake, 1 Los Angeles, 8 Tulare, 2 Ventura, 1	1.0 - 42.6	DHS MCL 1750  USEPA MCL 10000	Solvent. NR. There are no products currently registered for agricultural use in California that contain xylene as an active ingredient. Referred to SWRCB.



## **SECTION I SUMMARY**

From July 1, 1996 through June 30, 1997, results were reported for 2,508 wells, located in 48 counties, that were sampled for an overall total of 165 pesticide active ingredients or breakdown products. The data represent 28 investigations conducted by nine agencies from 1989 through 1997.

Of the 165 compounds, 22 pesticide active ingredients or breakdown products were reported detected in 437 wells in 24 counties. Verified detections were made of 11 compounds in 96 wells in seven counties.

Detections of the following chemicals were verified for the first time in the following counties: diuron in San Joaquin; hexazinone in San Joaquin and Stanislaus; norflurazon in Fresno and Tulare; simazine in Madera, Mendocino, and San Joaquin; TPA in Madera; ACET in San Joaquin; DACT in Fresno and Tulare; and DEA in San Joaquin. These are the first verified detections of DACT and norflurazon in California ground water.



## **II. ACTIONS TAKEN BY THE DEPARTMENT OF PESTICIDE REGULATION TO PREVENT PESTICIDES FROM ENTERING GROUND WATER AS A RESULT OF AGRICULTURAL USE**

### **ENVIRONMENTAL HAZARDS ASSESSMENT PROGRAM**

The Environmental Monitoring and Pest Management Branch's Environmental Hazards Assessment Program (EHAP) performs the lead role for implementing DPR's environmental protection programs. EHAP personnel design and conduct field studies of air, soil, and surface and ground water to determine the environmental fate of pesticides, and conduct monitoring surveys to determine the presence of pesticide residues in ground water. All sampling results reported to DPR with positive pesticide detections are reviewed and either referred to the SWRCB or further investigated by DPR. DPR uses results of these investigations to take actions to prevent pesticide contamination of ground water.

### **GROUND WATER PROTECTION TRAINING**

Ground water protection training for licensed PCAs is part of a comprehensive program designed to protect ground water from contamination due to the legal agricultural use of pesticides. The training is required for PCAs who write ground water protection advisories (GWPA's). GWPA's must be submitted before the county agricultural commissioner can issue permits to growers for crop uses of simazine, bromacil, and diuron in their respective Pesticide Management Zones (PMZs). A PMZ is approximately a one-square-mile area that has been determined to be vulnerable to ground water pollution. To be authorized to write a ground water protection advisory, a licensed PCA must have attended DPR-sponsored ground water protection training within the previous two years. The GWPA contains specific information for applying a regulated pesticide in a PMZ so as to reduce the potential for movement of the chemical into ground water.

DPR has conducted ground water protection training annually since 1989. Information is provided on the extent of pesticide residues in ground water, the sources of pesticide residues, the pathways by which contamination can occur, the factors which influence migration of pesticides to ground water, and measures which can be taken to decrease such movement. These measures include using proper storage, mixing, loading, rinsing and disposal procedures, and wellhead protection. Since the movement of pesticides to ground water is caused primarily by the dissolution of pesticide residues in water, training places special emphasis on incorporation of soil-applied pesticide residues and on proper irrigation





management. Incorporation helps shield residues from surface water runoff which can subsequently move into drainage (dry) wells and, thus, to ground water. Proper irrigation management reduces leaching of residues to ground water.

**THE PESTICIDE DETECTION RESPONSE PROCESS (conducted pursuant to sections 13149 through 13151 [FAC] of the PCPA)**

Under the provisions of the Pesticide Detection Response Process (PDRP, see glossary), EHAP investigates all reports of detections of pesticides in ground water from its own sampling program and from sampling conducted by other public agencies or private entities.

A pesticide is considered to be “found” in ground water if it is detected using an unequivocal detection method, or if the original detection is subsequently verified. DPR has established precise criteria for analytical methods which provide for an unequivocal detection and for determining if a detection is verified (Biermann 1989, 1996; see Appendix C).

EHAP determines if the detected pesticide could have resulted from the use of a currently registered pesticide and if the pesticide’s presence in ground water is due to agricultural use, i.e., the pesticide was properly applied according to the label directions of a pesticide registered for agricultural use and in accordance with federal and State laws and regulations.

In the past, unless the pesticide was detected in or immediately adjacent to its PMZ, DPR routinely conducted a “four-section survey” to help determine whether the detection was due to agricultural use. Sampling was conducted in the section of land of the original detection and in three adjacent sections of land. Often, these studies were located in areas that have been thoroughly investigated and would provide little additional useful information. In an effort to use resources in the most effective and efficient manner, DPR reviewed and modified its protocols for determining when field sampling is required (DPR, January 1996).

Under the new policy, EHAP conducts a four-section survey under the following conditions.

1. For reported detections of new active ingredients, that is, pesticide active ingredients for which a Director’s finding has not been made pursuant to FAC section 13150.
2. For pesticide active ingredients for which a Director’s finding has been made pursuant for FAC section 13150 [6800(a) list chemicals] and:
  - a. There has not been a previous detection of a pesticide in ground water in the section due to agricultural use, and,



- b. The sections included in the four-section study area do not include a section which is an adopted or recommended PMZ, and,
- c. The detection is not in an area identified by modeling as an area sensitive to ground water pollution, or,
- d. Conducting a well survey will provide new information that may be useful for vulnerability assessment.

In addition, DPR uses land use maps, pesticide use information, and surveys of potential “point” sources of pesticide residues to help make the agricultural use determination. Verified detections are determined to be due to legal agricultural use if all the following criteria are met (DPR, March 1996):

- 1. The residue detected (active ingredient, breakdown product, or any other specified ingredient) is from a pesticide that is registered for agricultural use in California.
- 2. The application of a pesticide in the vicinity of the detection was reasonably likely.
- 3. A point source was not a likely cause.
- 4. A non-agricultural use of the pesticide was not a likely source.
- 5. A non-pesticide source was not a likely cause.
- 6. The pesticide should be present in another adjacent section or verified within a second site within a ½ mile radius of original determination.

Verified detections of pesticide residues that are determined to be due to agricultural use and that have been previously formally reviewed by the Director are subject to the current applicable ground water regulations. Verified detections of pesticide residues that are determined to be due to agricultural use and that have not been previously formally reviewed by the Director are subject to special review specified in FAC section 13150. The purpose of the review is to determine whether continued registration, sale, and use of the compound will be allowed. A subcommittee of the PREC holds a hearing, evaluates information, and makes recommendations to the Director of DPR who then makes a determination regarding continued use of the compound in California.

The pesticide detection is removed from the PDRP and referred to the SWRCB if the pesticide is not currently registered for use; is registered for other than agricultural, outdoor industrial, or outdoor institutional use; or is detected in ground water not as a result of agricultural use. The SWRCB and the nine RWQCBs are responsible for protecting the beneficial uses of water, and for controlling all discharges of waste into waters of the State.



## **ACTIONS TAKEN BY DPR ON PESTICIDE DETECTIONS**

A total of 22 pesticide active ingredients and breakdown products were detected in well water and reported from July 1, 1996 through June 30, 1997.

EHAP did not conduct investigations for 9 of the 22 detected chemicals because they are not currently registered for agricultural use in California (1,2-D, benzene, chloromethane, DBCP, EDB, methylene chloride, naphthalene, unspecified trichlorobenzenes, and xylene). Those detections were referred to the SWRCB.

EHAP conducted monitoring studies or investigations for chemicals that are currently registered for agricultural use in California. These investigations are described below in three groups. First are chemicals that may have previously been reported and monitored for, but were removed from the PDRP and have not been reviewed by the PREC subcommittee. Second are chemicals that have previously been reviewed through the PDRP and by the PREC subcommittee and third, are chemicals for which investigations were completed without additional well monitoring. For each monitoring study, reported detections may not have been verified because (1) residues were not detected in follow-up sampling or (2) the original positive well could not be resampled. A description of each study is given in Appendix B.

### **Monitoring for pesticides not previously reviewed by the PREC subcommittee**

Studies were conducted in 5 counties for 3 active ingredients that have not been reviewed by the PREC subcommittee: chlorthal-dimethyl, hexazinone, and norflurazon. The studies are summarized in Table II-1 and the status of the detections are summarized in Table I-7.

### **Monitoring for pesticides previously reviewed through the PDRP and by the PREC subcommittee where additional well monitoring was conducted**

Studies were conducted in 5 counties for 3 active ingredients that have been reviewed by the PREC subcommittee: atrazine, bromacil, and simazine. The studies are summarized in Table II-2.

### **Investigations for pesticides previously reviewed through the PDRP and by the PREC subcommittee where additional well monitoring was not conducted**

EHAP completed one investigation for simazine and ACET in Fresno County. These detections were made during a previous study (soil cluster well sampling; study 130), the results of which were presented in the 1995 update report. Based on a preponderance of evidence, a legal agricultural use determination was made and PMZs were recommended.



### Chemical continuing in the PDRP

Based on the evidence from study 410 in Fresno County, norflurazon will continue in the AB2021 pesticide detection response process.

Table II-1 Monitoring studies conducted by the Department of Pesticide Regulation for reported detections of chemicals that have not previously been reviewed by the subcommittee of the Pesticide Registration and Evaluation Committee.

County	Initiating Chemical	Verified Detection(s)	Study Number
Madera	chlorthal-dimethyl	diuron, simazine, TPA (degradate of chlorthal-dimethyl)	415
Calaveras	hexazinone	none	413
Stanislaus	hexazinone	ACET, diuron	412
Fresno	norflurazon	atrazine, bromacil, diuron, norflurazon, prometon, simazine, ACET, DEA	410
Tulare	norflurazon	bromacil, diuron, simazine, ACET, DEA	409

Table II-2 Monitoring studies conducted by the Department of Pesticide Regulation for reported detections of chemicals that have previously been reviewed by the subcommittee of the Pesticide Registration and Evaluation Committee.

County	Initiating Chemical	Verified Detection(s)	Study Number
Monterey	atrazine	none	398
San Joaquin	atrazine, bromacil	atrazine, diuron, hexazinone, simazine, ACET, DEA	397
Butte	bromacil	none	399
Monterey	bromacil	none	394
San Joaquin	bromacil	DEA	411
Mendocino	simazine	none	396
Sutter	simazine	none	394, 405

1

2

3



## AGRICULTURAL USE DETERMINATIONS

As a result of well monitoring conducted from July 1, 1996 through June 30, 1997, and a review of land use and pesticide use data, a total of 45 wells in 6 counties were determined to contain pesticide residues as a result of non-point source, legal agricultural use (Table II-3). The pesticides and breakdown products are atrazine, bromacil, diuron, prometon, simazine, ACET, DEA, and TPA. Each investigation is described in Appendix B.

Table II-3. Number of wells with detections of pesticide active ingredients contained in products registered for use as of June 30, 1997, or breakdown products, that were determined, pursuant to Food and Agricultural Code section 13149, to be present in ground water as the result of non-point source, legal agricultural use. Results are for investigations completed by the Department of Pesticide Regulation from July 1, 1996 through June 30, 1997.

	Butte	Fresno	Madera	Mendocino	San Joaquin	Tulare	Total wells
atrazine	1	1			5		7
bromacil	1	3				4	8
diuron		15	2		2	2	21
prometon		1					1
simazine		15	3	2	1	8	29
ACET		15			2	6	23
DEA		2			5	2	9
TPA			3				3
Total wells	1	21	4	2	6	11	45



## RECOMMENDATIONS FOR PESTICIDE MANAGEMENT ZONES

DPR recommended 27 sections as new PMZs (Table II-4) as a result of the determinations. Recommended PMZs must be adopted in regulation before they are subject to regulatory controls. These are the first 2 sections recommended as PMZs for Madera County.

Table II-4. Number of sections recommended as Pesticide Management Zones by the Department of Pesticide Regulation from July 1, 1996 through June 30, 1997.

County	Chemical(s)	Sections
Butte	atrazine, bromacil	1
Fresno	diuron	1
	atrazine, diuron	1
	atrazine, simazine	2
	diuron, simazine	2
	atrazine, diuron, simazine	4
	atrazine, bromacil, diuron, simazine	2
	atrazine, diuron, prometon, simazine	1
Madera	simazine	1
	diuron, simazine	1
Mendocino	simazine	1
San Joaquin	atrazine	1
	atrazine, bromacil	1
	atrazine, diuron	1
	atrazine, simazine	1
	atrazine, diuron, simazine	1
Tulare	bromacil	2
	atrazine, simazine	3
<b>Total</b>	atrazine 19, bromacil 6, diuron 14, prometon 1, simazine 19	<b>27</b>



## **GROUNDWATER PROTECTION LIST MONITORING**

The Groundwater Protection List (GWPL) is a list of pesticides having the potential to pollute ground water. It is required pursuant to FAC section 13145(d) and placed in 3CCR section 6800. The GWPL is divided into sublists (a) and (b). Sublist (a) is comprised of chemicals detected in the soil or ground water as a result of legal agricultural use. Sublist (b) is comprised of chemicals that meet the conditions specified in FAC section 13145(d).

These are pesticide active ingredients whose physiochemical properties exceed or are less than certain values (called specific numerical values or SNVs,) and are (1) intended to be applied to or injected into the soil by ground-based application equipment or by chemigation or (2) the labels of which recommend that the application be followed, within 72 hours, by flood or furrow irrigation. In order to determine whether these sublist (b) chemicals have migrated to ground water, DPR is required to conduct monitoring.

In 1992, DPR placed 45 pesticides on the GWPL. The chemicals were prioritized to determine in which order and to what extent the pesticides should be monitored. Factors used to prioritize the pesticides included whether a pesticide active ingredient was detected in ground water due to non-point sources in other states, listing in the top priority group for implementing the Birth Defect Prevention Act (SB950), physiochemical factors, and the amount of active ingredient sold per year.

In the last year, DPR revised its protocol for selecting which ground water protection list active ingredients would be monitored. Previously, monitoring was conducted only for pesticide active ingredients in the first priority group. Under the new protocol the active ingredients on the GWPL are not grouped in fixed priority categories. Rather, all chemicals on the list will be reviewed for their potential to contaminate ground water. The following information will be used to evaluate whether or not any of the pesticides have a high potential to pollute ground water:

1. Occurrence of the pesticide in ground water due to non-point source contamination anywhere in the U.S.
2. Physicochemical properties of the pesticide.
3. Pounds of pesticide applied in California, especially in areas known or suspected to be vulnerable to ground water pollution.
4. Agricultural practices for crops treated with the pesticide.

As a result of the review, one or more pesticides on the list will be selected for monitoring.



The new protocol also details how areas will be selected for monitoring. Monitoring efforts will be focused in areas that are known or suspected to be vulnerable to ground water contamination, areas where the number of pounds of a pesticide applied is high, or areas where total pesticide use is low, but highly concentrated. Also, domestic wells, which are generally shallower than other types of wells, will be targeted for monitoring. Up to 40 wells will be monitored.

Norflurazon, previously ranked in the third priority group, was selected for monitoring in 1996. This was because norflurazon was reported to have contaminated ground water in Florida after agricultural use. Also, norflurazon was applied for the past several years in areas of California where widespread ground water contamination by other herbicides has occurred, and it was being used as a substitute for simazine, a known ground water contaminant.

A total of 40 wells in 7 counties were sampled in August, 1996. Sampling areas were identified, in part, using the statistical classification method to identify vulnerable areas. This method is described in further detail below. Sampling results, by county and pesticide, are presented in Table II-5. Verified detections of norflurazon were made in one well each in Fresno and Tulare counties. Verified detections were also made of pesticides on sublist (a): bromacil, diuron, hexazinone, simazine, and ACET. This was the first time that a targeted GWPL sublist (b) chemical was detected in ground water.

Table II-5. Summary of sampling for norflurazon, a pesticide active ingredient placed on the Ground Water Protection List (Title 3, California Code of Regulation, section 6800(b)). Sampling was conducted by the Department of Pesticide Regulation between July 1, 1996 and June 30, 1997. The number of wells sampled for norflurazon, by county, and the number of wells with verified detections are given.

County	Wells Sampled	Wells with Verified Detections
Fresno	12	1
Kern	2	0
Madera	3	0
Merced	5	0
San	4	0
Stanislaus	4	0
Tulare	10	1
Total	40	2





## **SPECIAL STUDIES**

### **Ages and Types of Triazine Residues in Fresno and Tulare Counties**

Several hundred wells in Fresno and Tulare counties have had verified detections of the herbicides simazine, diuron, and bromacil. Simazine is a triazine herbicide. DPR is conducting a voluntary program to encourage agricultural best management practices in areas of Fresno and Tulare counties that are vulnerable to ground water contamination. The purpose of the program is to minimize or eliminate herbicide movement to ground water.

In discussions with the regulated community and the general public, two issues frequently arise: whether concentrations of herbicides in positive wells are increasing or decreasing, and whether the herbicide detections in ground water are associated with recent or historical herbicide use.

DPR conducted a cooperative study with the United States Geological Survey to investigate these issues and to evaluate the occurrence of triazine herbicide degradates in well water. Well water was analyzed for bromacil, diuron, simazine, and two simazine breakdown products, deethyl simazine (DES) and diaminochlorotriazine (DACT). The estimated time between herbicide application and detection in wells was determined using a new technique based on measuring chlorofluorocarbons (CFC) in well water samples. Thirty wells that had been found positive for simazine in 1994 were resampled in 1996 to determine if there was a trend in herbicide concentration. Some wells were also sampled and analyzed for CFCs.

Three major conclusions were made from this study: 1) In Fresno and Tulare county wells that are positive for simazine, simazine residues constitute only a fraction (10-20%) of the total triazine residues. All wells contained at least one of the simazine degradates; many contained simazine and both breakdown products; diuron and/or bromacil were also present in the majority of wells. 2) There was no significant change in herbicide concentrations in 30 domestic wells between 1994 and 1996. 3) The simazine, diuron, and bromacil detections in this study appear to be the result of recent herbicide applications. Estimated times between application and detection in well water ranged from 3 to 33 years, with more than half of the detections associated with applications made within the last decade. This finding also suggests that any changes in ground water quality arising from either regulatory changes or wide-spread voluntary adoption of agricultural management practices will probably not be discernible for at least 5 to 10 years. Over the next year, the department will review the significance of these findings.



## **A Voluntary Program of Modified Farm Management Practices to Prevent Herbicide Residues From Reaching Ground Water**

Residues of the herbicides simazine, diuron, and bromacil are associated with citrus and grape production and have been detected in several hundred domestic wells in Fresno and Tulare counties. Since degradation of pesticides or their breakdown products is generally much slower in ground water than at the surface, it may take many years for residues in ground water to dissipate.

EHAP has begun a three-year program to prevent additional residues from reaching ground water. In cooperation with the University of California Cooperative Extension (UCCE), EHAP has been working with growers, PCAs, the agricultural industry, and herbicide registrants to identify practical farm management alternatives that can reduce or prevent off-site movement of herbicides used in grape and citrus production.

One hypothesis of this program is that preemergent herbicides can be maintained on-site after application through site-specific farm management strategies. These management strategies might include modified irrigation, weed control, or application methods. Recent EHAP studies also demonstrate that preventing residues from moving off-site can have a positive effect on herbicide efficacy. In some cases, reduced-use or non-use pest management practices that prevent herbicide movement to ground water may be most practical.

Two core groups, one for grapes and one for citrus, consisting of growers, PCAs and farm advisors have been established by UCCE. These groups have begun to identify and prioritize management practices that minimize off-site movement of herbicides in grapes and citrus. EHAP has also sought the input of pesticide registrants, commodity groups, and other interested parties to find potential solutions to herbicide movement to ground water. Selected management practices have begun to be evaluated in field sites under actual growing conditions by UCCE and DPR. Evaluation criteria include herbicide movement, yield, tree or vine health, and root health. Workshops will be used to demonstrate management practices.

## **Using Multiple Factors To Identify Areas Vulnerable to Ground Water Contamination**

For several years, EHAP scientists have been developing an approach that integrates climatic, soil, and geographic data in analyses of their combined influence on the movement of pesticides to ground water. EHAP scientists continue to examine this method of identifying areas in California that are vulnerable to ground water pollution by the legal agricultural use



of pesticides. Specifically, research was aimed at gaining confidence in a statistical classification method (Troiano, *et al.*, 1997). This method, combined with additional information such as depth to ground water, provides a basis for development of regional agricultural management practices and regulatory options to reduce ground water contamination by pesticides. This method was used during Ground Water Protection List Monitoring for norflurazon to identify vulnerable areas where there should have been a higher probability of detecting norflurazon in ground water. The process appeared successful.

#### **FACTORS CONTRIBUTING TO PESTICIDE MOVEMENT TO GROUND WATER AS A RESULT OF AGRICULTURAL USE**

The PCPA requires DPR to include in the annual report an analysis of the factors that contribute to the movement of pesticides to ground water. Factors which determine the probability of an agricultural use pesticide reaching ground water include the chemical's physiochemical properties, pesticide formulation, site of application, soil type, climate, and irrigation practices. Many of these factors have been investigated by DPR, as described above in the special studies.

Pesticides may reach ground water by leaching or direct streaming. Leaching is the process by which pesticide residues are dissolved or suspended in water and are carried through the soil matrix as it recharges a ground water aquifer. Direct streaming is the movement of a pesticide to ground water through conduits. A natural conduit includes structures such as sink holes, macropores, insect and animal burrows, root channels, and deep cracks in clay soils. Man-made conduits include poorly constructed or damaged well seals or casings, agricultural drainage wells (dry wells), and improperly abandoned water, oil, or natural gas wells.

Ground water contamination may arise from point or non-point sources. Point source contamination occurs when the pesticide comes from a defined area such as from spills (improper handling, storage, disposal), or direct injection into ground water during mixing or chemigation. Non-point source contamination occurs when pesticides reach ground water from a large area, typically as a result of movement of pesticide after an agricultural application.



## **SECTION II SUMMARY**

From July 1, 1996 through June 30, 1997, EHAP sampled 179 wells in 12 counties. The samples were analyzed for a total of 16 pesticide active ingredients and breakdown products. Verified detections were made in 96 wells in 7 counties of 11 compounds: atrazine, bromacil, diuron, prometon, simazine, hexazinone, norflurazon, ACET, DACT, DEA, and TPA

DPR determined that residues of atrazine, bromacil, diuron, prometon, simazine, ACET, DEA, and TPA reached ground water as the result of legal, agricultural use in a total of 45 wells in 6 counties. A total of 27 sections in 6 counties were recommended as PMZs.





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## Appendix A

### Number of wells sampled and positive detections, by county and chemical

This appendix is presented in two sections. The first contains summaries for counties without any pesticide detection. The second contains summaries for counties with any detection. In each section, the counties are given alphabetically. Sampling results are reported for the period July 1, 1996 through June 30, 1997. The counties without and with detections are as follows:

#### Counties without detections

Alameda	Placer
Amador	Plumas
Colusa	San Diego
Contra Costa	San Francisco
El Dorado	San Luis Obispo
Glenn	Santa Barbara
Humboldt	Santa Clara
Inyo	Siskiyou
Marin	Sutter
Mariposa	Tehama
Modoc	Tuolumne
Orange	Yolo

#### Counties with detections

Butte	Riverside
Calaveras	Sacramento
Fresno	San Bernardino
Kern	San Joaquin
Kings	San Mateo
Lake	Santa Cruz
Los Angeles	Solano
Madera	Sonoma
Mendocino	Stanislaus
Merced	Tulare
Monterey	Ventura
Napa	Yuba

#### Counties where sampling was not conducted

Alpine	Nevada
Del Norte	San Benito
Imperial	Shasta
Lassen	Sierra
Mono	Trinity



Appendix A part 1. Counties without any detection. The chemicals and number of wells sampled for each chemical is given.

ALAMEDA: for each chemical, 5 wells were sampled.

ALACHLOR	ETHYLENE DIBROMIDE	METHOXYCHLOR
ATRAZINE	HEXACHLOROBENZENE	SIMAZINE
DBCP	LINDANE (GAMMA-BHC)	

AMADOR

1,1,2,2-TETRACHLOROETHANE	2	BUTACHLOR	1	NAPHTHALENE	2
1,2,4-TRICHLOROBENZENE	2	CHLOROMETHANE	2	ORTHO-DICHLOROBENZENE	2
1,2-D + 1,3-D + C-3 COMPOUNDS	2	DIAZINON	1	PROMETRYN	1
1,2-DICHLOROPROPANE (1,2-D)	2	DIMETHOATE	1	SIMAZINE	1
ALACHLOR	1	METHYL BROMIDE	2	THIOBENCARB	1
ATRAZINE	1	METOLACHLOR	1	TRICHLOROBENZENES	2
BENZENE	2	METRIBUZIN	1	XYLENE	2
BROMACIL	1	MOLINATE	1		

COLUSA: for each chemical, 1 well was sampled.

3-HYDROXYCARBOFURAN	ALDICARB SULFOXIDE	DIURON
ALDICARB	CARBARYL	METHOMYL
ALDICARB SULFONE	CARBOFURAN	OXAMYL

CONTRA COSTA

1,1,2,2-TETRACHLOROETHANE	4	CHLORDANE	5	LINDANE (GAMMA-BHC)	5
1,2,4-TRICHLOROBENZENE	4	CHLOROMETHANE	4	METHOMYL	6
1,2-D + 1,3-D + C-3 COMPOUNDS	4	CHLOROTHALONIL	4	METHOXYCHLOR	5
1,2-DICHLOROPROPANE (1,2-D)	4	DALAPON	5	METHYL BROMIDE	4
2,4,5-TP (SILVEX)	5	DBCP	5	METOLACHLOR	5
2,4-D	5	DIAZINON	5	METRIBUZIN	5
3-HYDROXYCARBOFURAN	6	DICAMBA	5	MOLINATE	5
ALACHLOR	5	DIELDRIN	5	NAPHTHALENE	6
ALDICARB	6	DIMETHOATE	5	ORTHO-DICHLOROBENZENE	4
ALDICARB SULFONE	6	DINOSEB	5	OXAMYL	6
ALDICARB SULFOXIDE	6	DIQUAT DIBROMIDE	6	PICLORAM	5
ALDRIN	5	DIURON	4	PROMETRYN	5
ATRAZINE	5	ENDOTHALL	5	PROPACHLOR	5
BENTAZON, SODIUM SALT	5	ENDRIN	5	SIMAZINE	5
BENZENE	4	ETHYLENE DIBROMIDE	5	THIOBENCARB	5
BROMACIL	5	GLYPHOSATE,	6	TOXAPHENE	5
BUTACHLOR	5	ISOPROPYLAMINE SALT		TRICHLOROBENZENES	4
CARBARYL	6	HEPTACHLOR	5	XYLENE	4
CARBOFURAN	6	HEPTACHLOR EPOXIDE	5		
		HEXACHLOROBENZENE	5		



Appendix A part 1 continued. Counties without any detection. The chemicals and number of wells sampled for each chemical is given.

#### EL DORADO

1,1,2,2-TETRACHLOROETHANE	28	BENZENE	28	ORTHO-DICHLOROBENZENE	28
1,2,4-TRICHLOROBENZENE	28	CHLOROMETHANE	4	TRICHLOROBENZENES	4
1,2-D + 1,3-D + C-3 COMPOUNDS	4	METHYL BROMIDE	4	XYLENE	28
1,2-DICHLOROPROPANE (1,2-D)	28	NAPHTHALENE	4		

#### GLENN

ATRAZINE	9	DIMETHOATE	5	PROMETRYN	9
BROMACIL	9	DIURON	1	PROPACHLOR	9
BUTACHLOR	9	METOLACHLOR	9	SIMAZINE	5
CHLOROTHALONIL	1	METRIBUZIN	9	THIOBENCARB	5
DIAZINON	9	MOLINATE	9		

#### HUMBOLDT

1,3-DICHLOROPROPENE (1,3-D TELONE)	33	DEMETON	33	METHYL CHLORPYRIFOS	33
1,1,2,2-TETRACHLOROETHANE	33	DIAZINON	33	METHYL PARATHION	33
1,2-DICHLOROPROPANE (1,2-D)	33	DICAMBA	1	METHYLENE CHLORIDE	33
2,4,5-TP (SILVEX)	1	DIELDRIN	34	MEVINPHOS (PHOSDRIN)	33
2,4-D	1	DIMETHOATE	33	MEXACARBATE	33
ACEPHATE	33	DINOSEB	1	NALED	33
ALACHLOR	34	DISULFOTON	33	ORTHO-DICHLOROBENZENE	33
ALDRIN	34	ENDOSULFAN	33	ORTHO-DICHLOROBENZENE, OTHER RELATED	33
AMETRYNE	33	ENDOSULFAN II	33	OXAMYL	33
ATRATON	33	ENDOSULFAN SULFATE	33	PARATHION OR ETHYL PARATHION	33
AZINPHOS-METHYL (GUTHION)	33	ENDRIN	34	PHORATE	33
BENTAZON, SODIUM SALT	1	ENDRIN ALDEHYDE	33	PICLORAM	1
BENZENE	33	ETHION	33	PROPHAM	33
BHC (OTHER THAN GAMMA ISOMER)	33	ETHOPROP (PROPHOS)	33	PROPOXUR	33
CHLORDANE	34	ETHYLENE DIBROMIDE	33	PROTHIOFOS	33
CHLOROMETHANE	33	FENAMIPHOS	33	RONNEL	33
CHLOROPICRIN	33	FENSULFOTHION	33	SULPROFOS	33
CHLORPYRIFOS	33	FENTHION	33	SWEP	33
CHLORTHAL-DIMETHYL ACID	33	HEPTACHLOR	34	(3,4-DICHLOROCARBANILATE)	
METABOLITES		HEPTACHLOR EPOXIDE	34	TETRACHLORVINPHOS	33
COUMAPHOS	33	HEXACHLOROBENZENE	1	(STIROFOS)	
DALAPON	1	LINDANE (GAMMA-BHC)	34	TOXAPHENE	34
DBCP	33	MALATHION	33	TRICHLORONATE	33
DDVP (DICHLORVOS)	33	METHOMYL	33		
		METHOXYCHLOR	1		
		METHYL BROMIDE	33		

INYO: for each chemical , 4 wells were sampled.

1,1,2,2-TETRACHLOROETHANE	BENZENE	ORTHO-DICHLOROBENZENE
1,2,4-TRICHLOROBENZENE	CHLOROMETHANE	TRICHLOROBENZENES
1,2-D + 1,3-D + C-3 COMPOUNDS	METHYL BROMIDE	XYLENE
1,2-DICHLOROPROPANE (1,2-D)	NAPHTHALENE	





Appendix A part 1 continued. Counties without any detection. The chemicals and number of wells sampled for each chemical is given.

MARIN: for each chemical, 1 well was sampled.

1,1,2,2-TETRACHLOROETHANE	BENZENE	TRICHLOROENZENES
1,2,4-TRICHLOROBENZENE	CHLOROMETHANE	XYLENE
1,2-D + 1,3-D + C-3 COMPOUNDS	METHYL BROMIDE	
1,2-DICHLOROPROPANE (1,2-D)	ORTHO-DICHLOROBENZENE	

MARIPOSA: 1 well was sampled for hexazinone.

MODOC: for each chemical, 4 wells were sampled.

1,3-DICHLOROPROPENE (1,3-D TELONE)	CARBON TETRACHLORIDE	LINDANE (GAMMA-BHC)
1,1,2,2-TETRACHLOROETHANE	CHLORDANE	METHIOCARB
1,2,4-TRICHLOROBENZENE	CHLOROMETHANE	METHOMYL
1,2-DICHLOROPROPANE (1,2-D)	CHLOROPICRIN	METHOXYCHLOR
1,4-DICHLOROBENZENE (P-DCB)	CHLOROTHALONIL	METHYL BROMIDE
2,4,5-T	DALAPON	METHYL CHLOROFORM
2,4,5-TP (SILVEX)	DBCP	METHYLENE CHLORIDE
2,4-D	DEMETON	METOLACHLOR
3-HYDROXYCARBOFURAN	DIAZINON	METRIBUZIN
ALACHLOR	DICAMBA	MOLINATE
ALDICARB	DIELDRIN	NAPHTHALENE
ALDICARB SULFONE	DIMETHOATE	ORTHO-DICHLOROBENZENE
ALDICARB SULFOXIDE	DINOSEB	OXAMYL
ALDRIN	DIQUAT DIBROMIDE	PENTACHLOROPHENOL (PCP)
AROCLOR	DISULFOTON	PICLORAM
ATRAZINE	ENDOTHALL	PROMETRYN
BENTAZON, SODIUM SALT	ENDRIN	PROPACHLOR
BENZENE	ETHYLENE DIBROMIDE	SIMAZINE
BIS(2-ETHYLHEXYL)PHTHALATE	ETHYLENE DICHLORIDE	THIOBENCARB
BROMACIL	FORMETANATE	TOLUENE
BUTACHLOR	HYDROCHLORIDE	TOXAPHENE
CARBARYL	HEPTACHLOR	ZIRAM
CARBOFURAN	HEPTACHLOR EPOXIDE	
	HEXACHLOROBENZENE	



Appendix A part 1 continued. Counties without any detection. The chemicals and number of wells sampled for each chemical is given.

## ORANGE

1,3-DICHLOROPROPENE (1,3-D TELONE)	172	CHLOROTHALONIL	18	MALATHION	50
1,1,2,2-TETRACHLOROETHANE	177	DALAPON	14	METHIOCARB	13
1,2,4-TRICHLOROBENZENE	177	DBCP	176	METHOMYL	17
1,2-D + 1,3-D + C-3 COMPOUNDS	177	DDD	14	METHOXYCHLOR	18
1,2-DICHLOROPROPANE (1,2-D)	174	DDE	14	METHYL BROMIDE	177
2,4,5-TP (SILVEX)	14	DDT	14	METHYL PARATHION	50
2,4-D	14	DIAZINON	55	METOLACHLOR	56
3-HYDROXYCARBOFURAN	17	DICAMBA	14	METRIBUZIN	53
ACENAPHTHENE	13	DIELDRIN	18	MOLINATE	59
ALACHLOR	19	DIMETHOATE	55	NAPHTHALENE	181
ALDICARB	17	DINOSEB	14	ORTHO-DICHLOROBENZENE	177
ALDICARB SULFONE	17	DIQUAT DIBROMIDE	18	OXAMYL	17
ALDICARB SULFOXIDE	17	DIURON	14	PARAQUAT DICHLORIDE	14
ALDRIN	18	ENDOSULFAN	14	PARATHION OR ETHYL PARATHION	50
ATRAZINE	59	ENDOSULFAN SULFATE	14	PICLORAM	14
BENTAZON, SODIUM SALT	14	ENDOTHALL	17	PROMETRYN	58
BENZENE	177	ENDRIN	18	PROPACHLOR	56
BHC (OTHER THAN GAMMA ISOMER)	14	ENDRIN ALDEHYDE	14	PROPOXUR	13
BROMACIL	58	ETHYLENE DIBROMIDE	176	SIMAZINE	59
BUTACHLOR	56	GLYPHOSATE,	12	THIOBENCARB	59
CARBARYL	17	ISOPROPYLAMINE SALT		TOXAPHENE	18
CARBOFURAN	17	HEPTACHLOR	18	TRICHLOROBENZENES	177
CHLORDANE	18	HEPTACHLOR EPOXIDE	18	XYLENE	177
CHLOROMETHANE	177	HEXACHLOROBENZENE	18		
		LINDANE (GAMMA-BHC)	18		

PLACER: for each chemical, 3 wells were sampled.

1,1,2,2-TETRACHLOROETHANE	BENZENE	TRICHLOROBENZENES
1,2,4-TRICHLOROBENZENE	CHLOROMETHANE	XYLENE
1,2-D + 1,3-D + C-3 COMPOUNDS	METHYL BROMIDE	
1,2-DICHLOROPROPANE (1,2-D)	NAPHTHALENE	
	ORTHO-DICHLOROBENZENE	

## PLUMAS

ATRAZINE	1
BROMACIL	1
SIMAZINE	2



Appendix A part 1 continued. Counties without any detection. The chemicals and number of wells sampled for each chemical is given.

## SAN DIEGO

1,3-DICHLOROPROPENE (1,3-D TELONE)	1	CARBARYL	1	HEXACHLOROBENZENE	1
1,1,2,2-TETRACHLOROETHANE	2	CARBOFURAN	1	LINDANE (GAMMA-BHC)	1
1,2,4-TRICHLOROBENZENE	2	CHLORDANE	1	METHOMYL	1
1,2-D + 1,3-D + C-3 COMPOUNDS	2	CHLOROMETHANE	2	METHOXYCHLOR	1
1,2-DICHLOROPROPANE (1,2-D)	2	DALAPON	2	METHYL BROMIDE	2
2,4,5-TP (SILVEX)	2	DBCP	3	METOLACHLOR	2
2,4-D	2	DIAZINON	3	METRIBUZIN	2
3-HYDROXYCARBOFURAN	1	DICAMBA	1	MOLINATE	3
ALACHLOR	2	DIELDRIN	1	NAPHTHALENE	2
ALDICARB	1	DIMETHOATE	1	ORTHO-DICHLOROBENZENE	2
ALDICARB SULFONE	1	DINOSEB	2	OXAMYL	1
ALDICARB SULFOXIDE	1	DIQUAT DIBROMIDE	2	PICLORAM	2
ALDRIN	1	DIURON	1	PROMETON	1
ATRAZINE	3	ENDOTHALL	2	PROMETRYN	2
BENTAZON, SODIUM SALT	2	ENDRIN	1	PROPACHLOR	2
BENZENE	2	ETHYLENE DIBROMIDE	3	SIMAZINE	3
BROMACIL	3	GLYPHOSATE,	2	THIOBENCARB	2
BUTACHLOR	2	ISOPROPYLAMINE SALT	1	TOXAPHENE	1
		HEPTACHLOR	1	TRICHLOROBENZENES	2
		HEPTACHLOR EPOXIDE	1	XYLENE	1

SAN FRANCISCO for each chemical, 11 wells were sampled.

2,4,5-TP (SILVEX)	DDT	HEPTACHLOR
2,4-D	DIELDRIN	HEPTACHLOR EPOXIDE
ALDRIN	ENDOSULFAN	LINDANE (GAMMA-BHC)
ATRAZINE	ENDOSULFAN II	METHOXYCHLOR
BENTAZON, SODIUM SALT	ENDOSULFAN SULFATE	MOLINATE
BHC (OTHER THAN GAMMA ISOMER)	ENDRIN	SIMAZINE
CHLORDANE	ENDRIN ALDEHYDE	THIOBENCARB
DDD	ENDRIN KETONE	TOXAPHENE
DDE	GLYPHOSATE,	
	ISOPROPYLAMINE SALT	



Appendix A part 1 continued. Counties without any detection. The chemicals and number of wells sampled for each chemical is given.

## SAN LUIS OBISPO

1,1,2,2-TETRACHLOROETHANE	30	CHLORDANE	36	LINDANE (GAMMA-BHC)	29
1,2,4-TRICHLOROBENZENE	30	CHLOROMETHANE	30	METHOMYL	28
1,2-D + 1,3-D + C-3 COMPOUNDS	30	CHLOROTHALONIL	29	METHOXYCHLOR	29
1,2-DICHLOROPROPANE (1,2-D)	30	DALAPON	29	METHYL BROMIDE	30
2,4,5-TP (SILVEX)	29	DBCP	29	METOLACHLOR	28
2,4-D	29	DIAZINON	29	METRIBUZIN	28
3-HYDROXYCARBOFURAN	28	DICAMBA	28	MOLINATE	29
ALACHLOR	29	DIELDRIN	35	NAPHTHALENE	30
ALDICARB	28	DIMETHOATE	28	ORTHO-DICHLOROBENZENE	30
ALDICARB SULFONE	28	DINOSEB	29	OXAMYL	28
ALDICARB SULFOXIDE	28	DIQUAT DIBROMIDE	29	PICLORAM	29
ALDRIN	35	DIURON	27	PROMETRYN	28
ATRAZINE	36	ENDOTHALL	1	PROPACHLOR	28
BENTAZON, SODIUM SALT	29	ENDRIN	29	SIMAZINE	36
BENZENE	30	ETHYLENE DIBROMIDE	29	THIOBENCARB	29
BROMACIL	29	GLYPHOSATE,	1	TOXAPHENE	29
BUTACHLOR	28	ISOPROPYLAMINE SALT		TRICHLOROBENZENES	30
CARBARYL	29	HEPTACHLOR	29	XYLENE	30
CARBOFURAN	29	HEPTACHLOR EPOXIDE	29		
		HEXACHLOROBENZENE	29		

## SANTA BARBARA

1,1,2,2-TETRACHLOROETHANE	12	CHLORDANE	11	LINDANE (GAMMA-BHC)	9
1,2,4-TRICHLOROBENZENE	12	CHLOROMETHANE	12	METHOMYL	7
1,2-D + 1,3-D + C-3 COMPOUNDS	12	CHLOROTHALONIL	9	METHOXYCHLOR	11
1,2-DICHLOROPROPANE (1,2-D)	12	DALAPON	9	METHYL BROMIDE	12
2,4,5-TP (SILVEX)	9	DBCP	19	METOLACHLOR	15
2,4-D	9	DIAZINON	19	METRIBUZIN	15
3-HYDROXYCARBOFURAN	7	DICAMBA	5	MOLINATE	19
ALACHLOR	19	DIELDRIN	25	NAPHTHALENE	12
ALDICARB	7	DIMETHOATE	19	ORTHO-DICHLOROBENZENE	12
ALDICARB SULFONE	7	DINOSEB	9	OXAMYL	11
ALDICARB SULFOXIDE	7	DIQUAT DIBROMIDE	9	PICLORAM	11
ALDRIN	25	DIURON	9	PROMETRYN	28
ATRAZINE	21	ENDOTHALL	1	PROPACHLOR	5
BENTAZON, SODIUM SALT	9	ENDRIN	11	SIMAZINE	21
BENZENE	12	ETHYLENE DIBROMIDE	19	THIOBENCARB	19
BROMACIL	19	GLYPHOSATE,	1	TOXAPHENE	9
BUTACHLOR	15	ISOPROPYLAMINE SALT		TRICHLOROBENZENES	12
CARBARYL	11	HEPTACHLOR	11	XYLENE	12
CARBOFURAN	11	HEPTACHLOR EPOXIDE	11		
		HEXACHLOROBENZENE	9		





Appendix A part 1 continued. Counties without any detection. The chemicals and number of wells sampled for each chemical is given.

## SANTA CLARA

1,1,2,2-TETRACHLOROETHANE	12	CARBARYL	3	GLYPHOSATE,	2
1,2,4-TRICHLOROBENZENE	12	CARBOFURAN	3	ISOPROPYLAMINE SALT	
1,2-D + 1,3-D + C-3	12	CHLORDANE	28	HEPTACHLOR	28
COMPOUNDS		CHLOROMETHANE	12	HEPTACHLOR EPOXIDE	28
1,2-DICHLOROPROPANE (1,2-D)	12	CHLOROTHALONIL	9	HEXACHLOROBENZENE	9
2,3,7,8-TCDD (DIOXIN)	1	DALAPON	16	LINDANE (GAMMA-BHC)	28
2,4,5-T	20	DBCP	10	METHOMYL	3
2,4,5-TP (SILVEX)	35	DDD	20	METHOXYCHLOR	17
2,4-D	35	DDE	20	METHYL BROMIDE	12
3-HYDROXYCARBOFURAN	3	DDT	20	METOLACHLOR	9
4(2,4-DB), BUTOXYETHANOL	20	DIAZINON	9	METRIBUZIN	9
ESTER		DICAMBA	16	MOLINATE	9
ALDICARB	3	DIELDRIN	28	NAPHTHALENE	34
ALDICARB SULFONE	3	DIMETHOATE	9	ORTHO-DICHLOROBENZENE	12
ALDICARB SULFOXIDE	3	DINOSEB	16	OXAMYL	3
ALDRIN	28	DIQUAT DIBROMIDE	10	PICLORAM	16
AROCLOR	20	ENDOSULFAN	20	PROMETRYN	9
ATRAZINE	9	ENDOSULFAN II	20	SIMAZINE	9
BENTAZON, SODIUM SALT	16	ENDOSULFAN SULFATE	20	THIOBENCARB	9
BENZENE	12	ENDOTHALL	3	TOXAPHENE	28
BHC (OTHER THAN GAMMA	20	ENDRIN	28	TRICHLOROBENZENES	12
ISOMER)		ENDRIN ALDEHYDE	20	XYLENE	12
BROMACIL	9	ETHYLENE DIBROMIDE	9		
BUTACHLOR	9				

SISKIYOU for each chemical, 9 wells were sampled

1,3-DICHLOROPROPENE	CARBOFURAN	HEXACHLOROBENZENE
(1,3-D TELONE)	CARBON TETRACHLORIDE	LINDANE (GAMMA-BHC)
1,1,2,2-TETRACHLOROETHANE	CHLORDANE	METHIOCARB
1,2,4-TRICHLOROBENZENE	CHLOROMETHANE	METHOMYL
1,2-DICHLOROPROPANE (1,2-D)	CHLOROPICRIN	METHOXYCHLOR
1,4-DICHLOROBENZENE	CHLOROTHALONIL	METHYL BROMIDE
(P-DCB)	DALAPON	METHYL CHLOROFORM
2,4,5-T	DBCP	METHYLENE CHLORIDE
2,4,5-TP (SILVEX)	DEMETON	METOLACHLOR
2,4-D	DIAZINON	METRIBUZIN
3-HYDROXYCARBOFURAN	DICAMBA	MOLINATE
ALACHLOR	DIELDRIN	NAPHTHALENE
ALDICARB	DIMETHOATE	ORTHO-DICHLOROBENZENE
ALDICARB SULFONE	DINOSEB	OXAMYL
ALDICARB SULFOXIDE	DIQUAT DIBROMIDE	PENTACHLOROPHENOL (PCP)
ALDRIN	DISULFOTON	PICLORAM
AROCLOR	ENDOTHALL	PROMETRYN
ATRAZINE	ENDRIN	PROPACHLOR
BENTAZON, SODIUM SALT	ETHYLENE DIBROMIDE	SIMAZINE
BENZENE	ETHYLENE DICHLORIDE	THIOBENCARB
BIS(2-ETHYLHEXYL)PHTHALATE	FORMETANATE	TOLUENE
BROMACIL	HYDROCHLORIDE	TOXAPHENE
BUTACHLOR	HEPTACHLOR	ZIRAM
CARBARYL	HEPTACHLOR EPOXIDE	



Appendix A part 1 continued. Counties without any detection. The chemicals and number of wells sampled for each chemical is given.

## SUTTER

ACET	5	DEETHYL-ATRAZINE	5	METRIBUZIN	6
ALACHLOR	1	DIAZINON	1	MOLINATE	1
ATRAZINE	6	DIMETHOATE	1	PROMETON	5
BENTAZON, SODIUM SALT	1	DIURON	7	PROMETRYN	6
BROMACIL	6	ETHYLENE DIBROMIDE	1	PROPACHLOR	1
BUTACHLOR	1	HEXAZINONE	5	SIMAZINE	7
CYANAZINE	5	METHOMYL	1	THIOBENCARB	1
DBCP	1	METOLACHLOR	2		

## TEHAMA

ALDRIN	2	ENDRIN	2	MOLINATE	5
ATRAZINE	5	HEPTACHLOR	2	PROMETRYN	5
BROMACIL	5	HEPTACHLOR EPOXIDE	2	PROPACHLOR	5
BUTACHLOR	5	HEXACHLOROBENZENE	2	SIMAZINE	2
CHLORDANE	2	LINDANE (GAMMA-BHC)	2	THIOBENCARB	2
DIAZINON	5	METHOXYCHLOR	2	TOXAPHENE	2
DIMETHOATE	2	METOLACHLOR	5		
DIURON	2	METRIBUZIN	5		

## TUOLUMNE

HEXAZINONE	2
NAPHTHALENE	1

## YOLO

1,1,2,2-TETRACHLOROETHANE	8	CARBARYL	6	METHOMYL	6
1,2,4-TRICHLOROBENZENE	8	CARBOFURAN	6	METHOXYCHLOR	6
1,2-D + 1,3-D + C-3	8	CHLORDANE	6	METHYL BROMIDE	8
COMPOUNDS		CHLOROMETHANE	8	METOLACHLOR	10
1,2-DICHLOROPROPANE (1,2-D)	8	CHLOROTHALONIL	6	METRIBUZIN	10
2,4,5-T	2	DALAPON	3	MOLINATE	10
2,4,5-TP (SILVEX)	6	DIAZINON	10	NAPHTHALENE	8
2,4-D	6	DICAMBA	6	ORTHO-DICHLOROBENZENE	8
3-HYDROXYCARBOFURAN	6	DIELDRIN	6	OXAMYL	6
4(2,4-DB), DIMETHYLAMINE	2	DIMETHOATE	10	PICLORAM	6
SALT		DINOSEB	6	PROMETRYN	10
ALACHLOR	10	DIURON	6	PROPACHLOR	10
ALDICARB	6	ENDRIN	6	PROPOXUR	2
ALDICARB SULFONE	6	ETHYLENE DIBROMIDE	6	SIMAZINE	10
ALDICARB SULFOXIDE	6	GLYPHOSATE,	6	THIOBENCARB	10
ALDRIN	6	ISOPROPYLAMINE SALT		TOXAPHENE	6
ATRAZINE	10	HEPTACHLOR	6	TRICHLOROBENZENES	8
BENTAZON, SODIUM SALT	6	HEPTACHLOR EPOXIDE	6	XYLENE	8
BENZENE	8	HEXACHLOROBENZENE	6		
BROMACIL	10	LINDANE (GAMMA-BHC)	6		
BUTACHLOR	10	METHIOCARB	2		



Appendix A part 2: Counties with any positive detections. The chemical, number of wells sampled, and number of wells with positive detections is given.

# BUTTE

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
3-HYDROXYCARBOFURAN	1		ENDRIN	1	
ACET	7		ETHYLENE DIBROMIDE	6	
ALDICARB	1		HEPTACHLOR	1	
ALDICARB SULFONE	1		HEPTACHLOR EPOXIDE	1	
ALDICARB SULFOXIDE	1		HEXACHLOROBENZENE	1	
ALDRIN	1		HEXAZINONE	7	
ATRAZINE	8	1	LINDANE (GAMMA-BHC)	1	
BROMACIL	8	1	METHOMYL	1	
BUTACHLOR	1		METHOXYCHLOR	1	
CARBARYL	1		METOLACHLOR	1	
CARBOFURAN	1		METRIBUZIN	8	
CHLORDANE	1		MOLINATE	1	
CYANAZINE	7		PROMETON	7	
DBCP	6		PROMETRYN	8	
DEETHYL-ATRAZINE	7		PROPACHLOR	1	
DIAZINON	1		SIMAZINE	7	
DIURON	8		TOXAPHENE	1	

# CALAVERAS

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
ATRAZINE	6		METOLACHLOR	1	
BROMACIL	6		METRIBUZIN	6	
BUTACHLOR	1		MOLINATE	1	
CYANAZINE	5		PROMETON	5	
DIAZINON	1		PROMETRYN	6	
DIMETHOATE	1		PROPACHLOR	1	
DIURON	6		SIMAZINE	6	
HEXAZINONE	6	1	THIOBENCARB	1	
CHEMICAL	SAMPLED	POS.			



Appendix A part 2 continued: Counties with any positive detections. The chemical, number of wells sampled, and number of wells with positive detections is given.

FRESNO

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
1,3-DICHLOROPROPENE (1,3-D TELONE)	14		DIELDRIN	9	
1,1,2,2-TETRACHLOROETHANE	132		DIMETHOATE	47	
1,2,4-TRICHLOROBENZENE	132		DINOSEB	8	
1,2-D + 1,3-D + C-3 COMPOUNDS	132		DIQUAT DIBROMIDE	5	
1,2-DICHLOROPROPANE (1,2-D)	132	1	DIURON	71	33
2,4,5-TP (SILVEX)	8		ENDOTHALL	5	
2,4-D	8		ENDRIN	10	
3-HYDROXYCARBOFURAN	5		ETHYLENE DIBROMIDE	285	7
ACET	45	28	GLYPHOSATE, ISOPROPYLAMINE SALT	5	
ALACHLOR	49		HEPTACHLOR	10	
ALDICARB	6		HEPTACHLOR EPOXIDE	10	
ALDICARB SULFONE	6		HEXACHLOROBENZENE	10	
ALDICARB SULFOXIDE	6		HEXAZINONE	43	
ALDRIN	9		HYDROXYSIMAZINE	7	
ATRAZINE	92	1	LINDANE (GAMMA-BHC)	10	
BENTAZON, SODIUM SALT	7		METHOMYL	5	
BENZENE	132		METHOXYCHLOR	10	
BROMACIL	115	16	METHYL BROMIDE	132	
BUTACHLOR	48		METOLACHLOR	48	
CARBARYL	10		METRIBUZIN	91	
CARBOFURAN	6		MOLINATE	48	
CHLORDANE	10		NAPHTHALENE	132	1
CHLOROMETHANE	131		NORFLURAZON	43	8
CHLOROTHALONIL	10		ORTHO-DICHLOROBENZENE	132	
CYANAZINE	43		OXAMYL	6	
DALAPON	8		PICLORAM	8	
DBCP	288	113	PROMETON	43	1
DEETHYL-ATRAZINE	62	26	PROMETRYN	90	
DEETHYLHYDROXYSIMAZINE	7		PROPACHLOR	47	
DACT	31	29	SIMAZINE	123	54
DIAMINOHYDROXYTRIAZINE	7		THIOBENCARB	48	
DIAZINON	48		TOXAPHENE	10	
DICAMBA	7		TRICHLOROBENZENES	132	
			XYLENE	132	





Appendix A part 2 continued: Counties with any positive detections. The chemical, number of wells sampled, and number of wells with positive detections is given.

# KERN

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
1,1,2,2-TETRACHLOROETHANE	11		DINOSEB	24	
1,2,4-TRICHLOROBENZENE	12		DIQUAT DIBROMIDE	23	
1,2-D + 1,3-D + C-3 COMPOUNDS	11		DISULFOTON	6	
1,2-DICHLOROPROPANE (1,2-D)	12	1	DIURON	23	
2,4,5-T	5		DMPA (ZYTRON)	5	
2,4,5-TP (SILVEX)	24		ENDOSULFAN	5	
2,4,6-TRICHLOROPHENOL	1		ENDOSULFAN SULFATE	5	
2,4-D	24		ENDOTHALL	23	
2,4-DINITROPHENOL	1		ENDRIN	25	
3-HYDROXYCARBOFURAN	10		ENDRIN ALDEHYDE	5	
ACENAPTHENE	1		ETHYLENE DIBROMIDE	76	2
ACET	2		GLYPHOSATE, ISOPROPYLAMINE	17	
ALACHLOR	28		SALT		
ALDICARB	11		HEPTACHLOR	25	
ALDICARB SULFONE	10		HEPTACHLOR EPOXIDE	25	
ALDICARB SULFOXIDE	10		HEXACHLOROBENZENE	24	
ALDRIN	13		HEXAZINONE	2	
ATRAZINE	32		LINDANE (GAMMA-BHC)	25	
BENEFIN (BENFLURALIN)	5		METHIOCARB	5	
BENTAZON, SODIUM SALT	24		METHOMYL	10	
BENZENE	12	1	METHOXYCHLOR	25	
BHC (OTHER THAN GAMMA ISOMER)	5		METHYL BROMIDE	11	
BROMACIL	27		METOLACHLOR	6	
BUTACHLOR	6		METRIBUZIN	8	
CAPTAN	5		MEVINPHOS (PHOSDRIN)	5	
CARBARYL	22		MOLINATE	23	
CARBOFURAN	23		NAPHTHALENE	8	
CARBOPHENOTHION	5		NITROFEN	5	
CHLORDANE	25		NORFLURAZON	2	
CHLOROMETHANE	11		ORTHO-DICHLOROBENZENE	12	
CHLOROTHALONIL	23		OXAMYL	23	
CYANAZINE	2		PENDIMETHALIN	5	
DALAPON	25		PENTACHLORONITROBENZENE (PCNB)	5	
DBCP	78	7	PICLORAM	21	
DDD	5		PROMETON	7	
DDE	5		PROMETRYN	13	
DDT	5		PROPACHLOR	6	
DEETHYL-ATRAZINE	2		PROPOXUR	5	
DEMETON	6		SIMAZINE	32	
DIAZINON	23		SIMETRYN	5	
DICAMBA	11		TERBUTRYN	5	
DICOFOL	5		THIOBENCARB	23	
DIELDRIN	12		TOXAPHENE	25	
DIMETHOATE	11		TRICHLOROBENZENES	11	
			XYLENE	12	1



Appendix A part 2 continued: Counties with any positive detections. The chemical, number of wells sampled, and number of wells with positive detections is given.

# KINGS

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
1,1,2,2-TETRACHLOROETHANE	1		CHLOROMETHANE	1	
1,2,4-TRICHLOROBENZENE	1		METHYL BROMIDE	1	
1,2-D + 1,3-D + C-3 COMPOUNDS	1		NAPHTHALENE	1	
1,2-DICHLOROPROPANE (1,2-D)	1		ORTHO-DICHLOROBENZENE	1	
BENZENE	1	1	TRICHLOROBENZENES	1	
			XYLENE	1	

# LAKE

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
1,1,2,2-TETRACHLOROETHANE	2		DIQUAT DIBROMIDE	8	
1,2,4-TRICHLOROBENZENE	2		DIURON	5	
1,2-D + 1,3-D + C-3 COMPOUNDS	2		ENDOTHALL	8	
1,2-DICHLOROPROPANE (1,2-D)	2		ENDRIN	5	
2,4,5-TP (SILVEX)	4		ETHYLENE DIBROMIDE	7	
2,4-D	4		HEPTACHLOR	5	
ATRAZINE	10		HEPTACHLOR EPOXIDE	5	
BENZENE	3	1	LINDANE (GAMMA-BHC)	5	
BROMACIL	5		METHOXYCHLOR	5	
CARBOFURAN	6		METHYL BROMIDE	2	
CHLORDANE	5		NAPHTHALENE	2	
CHLOROMETHANE	2		ORTHO-DICHLOROBENZENE	2	
CHLOROTHALONIL	5		OXAMYL	8	
DALAPON	10		PICLORAM	9	
DBCP	1		PROMETRYN	5	
DIAZINON	4		SIMAZINE	10	
DIMETHOATE	4		TOXAPHENE	5	
DINOSEB	8		TRICHLOROBENZENES	2	
			XYLENE	2	1



Appendix A part 2 continued: Counties with any positive detections. The chemical, number of wells sampled, and number of wells with positive detections is given.

# LOS ANGELES

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
1,3-DICHLOROPROPENE (1,3-D TELONE)	8		DINOSEB	76	
1,1,2,2-TETRACHLOROETHANE	332		DIQUAT DIBROMIDE	96	
1,2,4-TRICHLOROBENZENE	325		DIURON	76	
1,2-D + 1,3-D + C-3 COMPOUNDS	325		ENDOSULFAN	6	
1,2-DICHLOROPROPANE (1,2-D)	328		ENDOSULFAN SULFATE	6	
2,3,7,8-TCDD (DIOXIN)	5		ENDOTHALL	31	
2,4,5-TP (SILVEX)	76		ENDRIN	79	
2,4-D	100		ENDRIN ALDEHYDE	6	
3-HYDROXYCARBOFURAN	59		ETHYLENE DIBROMIDE	83	1
ALACHLOR	91		GLYPHOSATE, ISOPROPYLAMINE SALT	97	
ALDICARB	60		HEPTACHLOR	79	
ALDICARB SULFONE	60		HEPTACHLOR EPOXIDE	79	
ALDICARB SULFOXIDE	60		HEXACHLOROBENZENE	76	
ALDRIN	58		LINDANE (GAMMA-BHC)	79	
ATRAZINE	101		METHIOCARB	3	
BENTAZON, SODIUM SALT	76		METHOMYL	59	
BENZENE	332	3	METHOXYCHLOR	79	
BHC (OTHER THAN GAMMA ISOMER)	6		METHYL BROMIDE	332	
BROMACIL	98		METOLACHLOR	62	
BUTACHLOR	62		METRIBUZIN	62	
CARBARYL	138		MOLINATE	95	
CARBOFURAN	112		NAPHTHALENE	405	
CHLORDANE	103		ORTHO-DICHLOROBENZENE	332	
CHLOROMETHANE	332	1	OXAMYL	112	
CHLOROTHALONIL	67		PARAQUAT DICHLORIDE	5	
CHLOROTHAL-DIMETHYL	3		PICLORAM	76	
DALAPON	76		PROMETRYN	62	
DBCP	89	12	PROPACHLOR	55	
DDD	6		PROPOXUR	3	
DDE	6		SIMAZINE	101	
DDT	6		THIOBENCARB	98	
DIAZINON	97		TOXAPHENE	76	
DICAMBA	54		TRICHLOROBENZENES	325	
DIELDRIN	57		TRIFLURALIN	3	
DIMETHOATE	61		XYLENE	396	8



Appendix A part 2 continued: Counties with any positive detections. The chemical, number of wells sampled, and number of wells with positive detections is given.

#### MADERA

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
1,1,2,2-TETRACHLOROETHANE	1		ENDOTHALL	1	
1,2,4-TRICHLOROBENZENE	1		ENDRIN	1	
1,2-D + 1,3-D + C-3 COMPOUNDS	1		ETHYLENE DIBROMIDE	4	1
1,2-DICHLOROPROPANE (1,2-D)	1		GLYPHOSATE, ISOPROPYLAMINE	1	
3-HYDROXYCARBOFURAN	1		SALT		
ACET	3		HEPTACHLOR	1	
ALDICARB	1		HEPTACHLOR EPOXIDE	1	
ALDICARB SULFONE	1		HEXACHLOROBENZENE	1	
ALDICARB SULFOXIDE	1		HEXAZINONE	11	
ALDRIN	1		LINDANE (GAMMA-BHC)	1	
ATRAZINE	10		METHOMYL	1	
BENZENE	1		METHOXYCHLOR	1	
BROMACIL	10		METHYL BROMIDE	1	
BUTACHLOR	1		METOLACHLOR	1	
CARBARYL	1		METRIBUZIN	10	
CARBOFURAN	1		MOLINATE	1	
CHLORDANE	1		MTP	6	
CHLOROMETHANE	1		NAPHTHALENE	1	
CHLOROTHALONIL	1		NORFLURAZON	3	
CHLORTHAL-DIMETHYL	6		ORTHO-DICHLOROBENZENE	1	
CYANAZINE	9		PROMETON	9	
DBCP	4	2	PROMETRYN	10	
DEETHYL-ATRAZINE	3		SIMAZINE	9	3
DIAZINON	1		TOXAPHENE	1	
DIQUAT DIBROMIDE	1		TPA	6	3
DIURON	9	2	TRICHLOROBENZENES	1	
			XYLENE	1	

#### MENDOCINO

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
2,4,5-TP (SILVEX)	4		ENDOTHALL	5	
2,4-D	4		ENDRIN	2	
ACET	5		ETHYLENE DIBROMIDE	5	
ATRAZINE	14		GLYPHOSATE, ISOPROPYLAMINE	5	
BROMACIL	10		SALT		
CARBOFURAN	5		HEPTACHLOR	5	
CHLORDANE	2		HEPTACHLOR EPOXIDE	6	
CHLOROTHALONIL	5		HEXAZINONE	5	
CYANAZINE	5		LINDANE (GAMMA-BHC)	3	
DALAPON	6		METHOXYCHLOR	3	
DEETHYL-ATRAZINE	5		METRIBUZIN	5	
DIAZINON	5		OXAMYL	4	
DIMETHOATE	5		PICLORAM	3	
DINOSEB	5		PROMETON	5	
DIQUAT DIBROMIDE	5		PROMETRYN	10	
DIURON	10		SIMAZINE	13	2
			TOXAPHENE	3	





Appendix A part 2 continued: Counties with any positive detections. The chemical, number of wells sampled, and number of wells with positive detections is given.

MERCED

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
1,1,2,2-TETRACHLOROETHANE	16		DIMETHOATE	14	
1,2,4-TRICHLOROBENZENE	16		DINOSEB	4	
1,2-D + 1,3-D + C-3 COMPOUNDS	16		DIQUAT DIBROMIDE	8	
1,2-DICHLOROPROPANE (1,2-D)	16		DIURON	5	
2,4,5-TP (SILVEX)	4		ENDOTHALL	4	
2,4-D	4		ENDRIN	4	
3-HYDROXYCARBOFURAN	4		ETHYLENE DIBROMIDE	32	3
ACET	5		HEPTACHLOR	4	
ALACHLOR	14		HEPTACHLOR EPOXIDE	4	
ALDICARB	4		HEXACHLOROBENZENE	4	
ALDICARB SULFONE	4		HEXAZINONE	5	
ALDICARB SULFOXIDE	4		LINDANE (GAMMA-BHC)	4	
ALDRIN	4		METHOMYL	4	
ATRAZINE	19		METHOXYCHLOR	4	
BENTAZON, SODIUM SALT	4		METHYL BROMIDE	16	
BENZENE	16		METOLACHLOR	14	
BROMACIL	19		METRIBUZIN	15	
BUTACHLOR	14		MOLINATE	14	
CARBARYL	4		NAPHTHALENE	16	
CARBOFURAN	4		NORFLURAZON	5	
CHLORDANE	4		ORTHO-DICHLOROBENZENE	16	
CHLOROMETHANE	17	1	OXAMYL	4	
CHLOROTHALONIL	4		PICLORAM	4	
CYANAZINE	5		PROMETON	5	
DALAPON	4		PROMETRYN	19	
DBCP	33	13	PROPACHLOR	4	
DEETHYL-ATRAZINE	5		SIMAZINE	19	
DIAZINON	14		THIOBENCARB	14	
DICAMBA	4		TOXAPHENE	4	
DIELDRIN	4		TRICHLOROBENZENES	16	
			XYLENE	16	



Appendix A part 2 continued: Counties with any positive detections. The chemical, number of wells sampled, and number of wells with positive detections is given.

# MONTEREY

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
1,1,2,2-TETRACHLOROETHANE	8		DINOSEB	3	
1,2,4-TRICHLOROBENZENE	6		DIQUAT DIBROMIDE	1	
1,2-D + 1,3-D + C-3 COMPOUNDS	7		DIURON	7	
1,2-DICHLOROPROPANE (1,2-D)	8		ENDOTHALL	1	
2,4,5-TP (SILVEX)	3		ENDRIN	4	
2,4-D	3		ETHYLENE DIBROMIDE	3	
3-HYDROXYCARBOFURAN	1		GLYPHOSATE, ISOPROPYLAMINE	1	
ACET	7		SALT		
ALACHLOR	4		HEPTACHLOR	4	
ALDICARB	1		HEPTACHLOR EPOXIDE	4	
ALDICARB SULFONE	1		HEXACHLOROBENZENE	4	
ALDICARB SULFOXIDE	1		HEXAZINONE	7	
ALDRIN	4		LINDANE (GAMMA-BHC)	4	
ATRAZINE	8		METHOMYL	1	
BENTAZON, SODIUM SALT	3		METHOXYCHLOR	4	
BENZENE	8		METHYL BROMIDE	7	
BROMACIL	8		METOLACHLOR	1	
BUTACHLOR	1		METRIBUZIN	8	
CARBARYL	1		MOLINATE	1	
CARBOFURAN	1		NAPHTHALENE	7	
CHLORDANE	4		ORTHO-DICHLOROBENZENE	8	
CHLOROMETHANE	7	1	OXAMYL	1	
CHLOROTHALONIL	1		PICLORAM	3	
CYANAZINE	7		PROMETON	7	
DALAPON	3		PROMETRYN	8	
DBCP	3		PROPACHLOR	1	
DEETHYL-ATRAZINE	7		SIMAZINE	8	
DIAZINON	1		THIOBENCARB	1	
DICAMBA	1		TOXAPHENE	4	
DIELDRIN	4		TRICHLOROBENZENES	7	
DIMETHOATE	1		XYLENE	8	



Appendix A part 2 continued: Counties with any positive detections. The chemical, number of wells sampled, and number of wells with positive detections is given.

NAPA

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
1,3-DICHLOROPROPENE (1,3-D TELONE)	9		MERPHOS	9	
1,1,2,2-TETRACHLOROETHANE	9		METHIOCARB	9	
1,2-DICHLOROPROPANE (1,2-D)	9		METHOMYL	9	
2,4,5-T	9		METHYL BROMIDE	9	8
2,4,5-TP (SILVEX)	9		METHYL CHLOROFORM	9	
2,4-D	9		METHYL PARATHION	9	
AMINOCARB	9		METHYLENE CHLORIDE	9	5
ATRAZINE	9		METOLACHLOR	9	
AZINPHOS-METHYL (GUTHION)	9		METRIBUZIN	9	
BARBAN	9		MEVINPHOS (PHOSDRIN)	9	
BENZENE	6		MEXACARBATE	9	
BROMACIL	9		MOLINATE	9	
BUTACHLOR	9		MONURON	9	
CARBARYL	9		NALED	9	
CARBOFURAN	9		NEBURON	9	
CHLORPROPHAM	9		ORTHO-DICHLOROBENZENE	9	
CHLORPYRIFOS	9		ORTHO-DICHLOROBENZENE, OTHER RELATED	9	
COUMAPHOS	9		OXAMYL	9	
DALAPON	9		PHORATE	9	
DDVP (DICHLORVOS)	9		PROMETRYN	9	
DEMETON-S-METHYL	9		PROPACHLOR	9	
DIAZINON	9		PROPHAM	9	
DICAMBA	9		PROPOXUR	9	
DICHLORPROP	9		PROTHIOFOS	9	
DIMETHOATE	9		RONNEL	9	
DINOSEB	9		SIDURON	9	
DISULFOTON	9		SIMAZINE	9	
DIURON	9		SULPROFOS	9	
ETHOPROP (PROPHOS)	9		SWEP (3,4-DICHLOROCARBANILATE)	9	
FENSULFOTHION	9		TETRACHLORVINPHOS (STIROFOS)	9	
FENTHION	9		THIOBENCARB	9	
FENURON	9		TRICHLORONATE	9	
FLUOMETURON	9		XYLENE	6	
LINURON	9				
MCPP	9				



Appendix A part 2 continued: Counties with any positive detections. The chemical, number of wells sampled, and number of wells with positive detections is given.

RIVERSIDE

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
1,1,2,2-TETRACHLOROETHANE	14		DINOSEB	16	
1,2,4-TRICHLOROBENZENE	14		DIQUAT DIBROMIDE	1	
1,2-D + 1,3-D + C-3 COMPOUNDS	14		DIURON	23	
1,2-DICHLOROPROPANE (1,2-D)	17	1	ENDOTHALL	1	
2,4,5-TP (SILVEX)	16		ENDRIN	13	
2,4-D	16		ETHYLENE DIBROMIDE	82	2
3-HYDROXYCARBOFURAN	12		GLYPHOSATE, ISOPROPYLAMINE	11	
ALACHLOR	18		SALT		
ALDICARB	12		HEPTACHLOR	13	
ALDICARB SULFONE	12		HEPTACHLOR EPOXIDE	13	
ALDICARB SULFOXIDE	12		HEXACHLOROBENZENE	13	
ALDRIN	12		LINDANE (GAMMA-BHC)	13	
ATRAZINE	18		METHOMYL	12	
BENTAZON, SODIUM SALT	16		METHOXYCHLOR	13	
BENZENE	14		METHYL BROMIDE	14	
BROMACIL	17		METOLACHLOR	13	
BUTACHLOR	17		METRIBUZIN	17	
CARBARYL	12		MOLINATE	18	
CARBOFURAN	13		NAPHTHALENE	23	
CHLORDANE	13		ORTHO-DICHLOROBENZENE	14	
CHLOROMETHANE	14		OXAMYL	13	
CHLOROTHALONIL	12		PICLORAM	16	
DALAPON	16		PROMETRYN	17	
DBCP	82	16	PROPACHLOR	12	
DIAZINON	17		SIMAZINE	18	
DICAMBA	9		THIOBENCARB	18	
DIELDRIN	12		TOXAPHENE	13	
DIMETHOATE	17		TRICHLOROBENZENES	14	
			XYLENE	14	





Appendix A part 2 continued: Counties with any positive detections. The chemical, number of wells sampled, and number of wells with positive detections is given.

SACRAMENTO

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
1,1,2,2-TETRACHLOROETHANE	20		DINOSEB	28	
1,2,4-TRICHLOROBENZENE	20		DIQUAT DIBROMIDE	28	
1,2-D + 1,3-D + C-3 COMPOUNDS	19		DIURON	3	
1,2-DICHLOROPROPANE (1,2-D)	20		ENDOTHALL	3	
2,4,5-T	5		ENDRIN	28	
2,4,5-TP (SILVEX)	33		ETHYLENE DIBROMIDE	28	
2,4-D	33		GLYPHOSATE, ISOPROPYLAMINE	3	
3-HYDROXYCARBOFURAN	28		SALT		
ALACHLOR	28		HEPTACHLOR	28	
ALDICARB	28		HEPTACHLOR EPOXIDE	28	
ALDICARB SULFONE	28		HEXACHLOROBENZENE	28	
ALDICARB SULFOXIDE	28		LINDANE (GAMMA-BHC)	28	
ALDRIN	28		METHOMYL	28	
ATRAZINE	28		METHOXYCHLOR	28	
BENTAZON, SODIUM SALT	28		METHYL BROMIDE	19	
BENZENE	20	1	METOLACHLOR	28	
BROMACIL	28		METRIBUZIN	28	
BUTACHLOR	28		MOLINATE	28	
CARBARYL	28		NAPHTHALENE	19	
CARBOFURAN	28		ORTHO-DICHLOROBENZENE	20	
CHLORDANE	28		OXAMYL	28	
CHLOROMETHANE	19		PICLORAM	28	
CHLOROTHALONIL	28		PROMETRYN	28	
DALAPON	28		PROPACHLOR	28	
DBCP	28		SIMAZINE	28	
DIAZINON	28		THIOBENCARB	28	
DICAMBA	28		TOXAPHENE	28	
DIELDRIN	28		TRICHLOROBENZENES	19	
DIMETHOATE	28		XYLENE	20	



Appendix A part 2 continued: Counties with any positive detections. The chemical, number of wells sampled, and number of wells with positive detections is given.

SAN BERNARDINO

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
1,1,2,2-TETRACHLOROETHANE	186		DIMETHOATE	77	
1,2,4-TRICHLOROBENZENE	186		DINOSEB	62	
1,2-D + 1,3-D + C-3 COMPOUNDS	186		DIQUAT DIBROMIDE	3	
1,2-DICHLOROPROPANE (1,2-D)	186		DIURON	55	
2,3,7,8-TCDD (DIOXIN)	2		ENDOTHALL	1	
2,4,5-TP (SILVEX)	62		ENDRIN	52	
2,4-D	63		ETHYLENE DIBROMIDE	247	
3-HYDROXYCARBOFURAN	31		GLYPHOSATE, ISOPROPYLAMINE	60	
ACENAPTHENE	10		SALT		
ALACHLOR	91		HEPTACHLOR	49	
ALDICARB	31		HEPTACHLOR EPOXIDE	49	
ALDICARB SULFONE	31		HEXACHLOROBENZENE	49	
ALDICARB SULFOXIDE	31		LINDANE (GAMMA-BHC)	52	
ALDRIN	34		METHOMYL	31	
ATRAZINE	91		METHOXYCHLOR	52	
BENTAZON, SODIUM SALT	62		METHYL BROMIDE	186	
BENZENE	186		METOLACHLOR	77	
BROMACIL	91		METRIBUZIN	77	
BUTACHLOR	77		MOLINATE	91	
CARBARYL	45		NAPHTHALENE	215	
CARBOFURAN	45		ORTHO-DICHLOROBENZENE	184	
CHLORDANE	49		OXAMYL	45	
CHLOROMETHANE	189	2	PICLORAM	62	
CHLOROTHALONIL	49		PROMETRYN	77	
DALAPON	62		PROPACHLOR	34	
DBCP	251	57	SIMAZINE	91	
DIAZINON	90		THIOBENCARB	91	
DICAMBA	48		TOXAPHENE	49	
DIELDRIN	34		TRICHLOROBENZENES	186	
			XYLENE	184	



Appendix A part 2 continued: Counties with any positive detections. The chemical, number of wells sampled, and number of wells with positive detections is given.

# SAN JOAQUIN

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
1,3-DICHLOROPROPENE (1,3-D TELONE)	8		DIMETHOATE	9	
1,1,2,2-TETRACHLOROETHANE	1		DINOSEB	20	
1,2,4-TRICHLOROBENZENE	1		DIQUAT DIBROMIDE	17	
1,2-D + 1,3-D + C-3 COMPOUNDS	1		DIURON	40	2
1,2-DICHLOROPROPANE (1,2-D)	9		ENDOTHALL	20	
2,4,5-TP (SILVEX)	17		ENDRIN	6	
2,4-D	17		ETHYLENE DIBROMIDE	45	1
3-HYDROXYCARBOFURAN	18		HEPTACHLOR	13	
ACET	28	3	HEPTACHLOR EPOXIDE	13	
ALACHLOR	12		HEXACHLOROBENZENE	2	
ALDICARB	18		HEXAZINONE	28	2
ALDICARB SULFONE	18		LINDANE (GAMMA-BHC)	13	
ALDICARB SULFOXIDE	18		METHOMYL	18	
ALDRIN	2		METHOXYCHLOR	6	
ATRAZINE	37	5	METHYL BROMIDE	1	
BENTAZON, SODIUM SALT	13		METOLACHLOR	9	
BENZENE	1		METRIBUZIN	37	
BROMACIL	44		MOLINATE	2	
BUTACHLOR	9		NAPHTHALENE	1	
CARBARYL	18		NORFLURAZON	4	
CARBOFURAN	18		ORTHO-DICHLOROBENZENE	1	
CHLORDANE	6		OXAMYL	15	
CHLOROMETHANE	1		PARAQUAT DICHLORIDE	2	
CHLOROTHALONIL	11		PICLORAM	20	
CYANAZINE	28		PROMETON	28	
DALAPON	20		PROMETRYN	37	
DBCP	70	23	PROPACHLOR	2	
DEETHYL-ATRAZINE	28	6	SIMAZINE	37	1
DIAZINON	9		THIOBENCARB	2	
DICAMBA	20		TOXAPHENE	6	
DIELDRIN	2		TRICHLOROBENZENES	1	
			XYLENE	1	



Appendix A part 2 continued: Counties with any positive detections. The chemical, number of wells sampled, and number of wells with positive detections is given.

SAN MATEO

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
1,2-DICHLOROPROPANE (1,2-D)	2	2	ENDRIN	2	
2,4,5-T	1		EPTC	2	
2,4,5-TP (SILVEX)	1		FENAMIPHOS	2	
2,4-D	1		HEPTACHLOR	2	
ALACHLOR	2		HEPTACHLOR EPOXIDE	2	
ALDRIN	2		HEXAZINONE	2	
AMETRYNE	2		MERPHOS	2	
ATRATON	2		METHOXYCHLOR	2	
ATRAZINE	2		METRIBUZIN	2	
BENTAZON, SODIUM SALT	1		MOLINATE	2	
BROMACIL	2		NAPROPAMIDE	2	
BUTYLATE	2		PICLORAM	1	
CHLORDANE	2		PROMETON	2	
CHLORPROPHAM	2		PROMETRYN	2	
CHLORTHAL-DIMETHYL	1		PROPAZINE	2	
CYCLOATE	2		SIMAZINE	2	
DALAPON	1		SIMETRYN	2	
DDVP (DICHLORVOS)	2		TEBUTHIURON	2	
DEMETON	2		TERBUTRYN	2	
DIAZINON	2		TETRACHLORVINPHOS	2	
DIELDRIN	2		(STIROFOS)		
DINOSEB	1		TOXAPHENE	2	
DIPHENAMID	2		TRIADIMEFON	2	
DISULFOTON	2		TRICHLOROBENZENES	1	1
			VERNOLATE	2	





Appendix A part 2 continued: Counties with any positive detections. The chemical, number of wells sampled, and number of wells with positive detections is given.

# SANTA CRUZ

CHEMICAL	SAMPLED	POS.	CHEMICAL	
1,1,2,2-TETRACHLOROETHANE	3		CHLOROMETHANE	3
1,2,4-TRICHLOROBENZENE	3		METHYL BROMIDE	3
1,2-D + 1,3-D + C-3 COMPOUNDS	3		ORTHO-DICHLOROBENZENE	3
1,2-DICHLOROPROPANE (1,2-D)	3		TRICHLOROBENZENES	3
BENZENE	3	1	XYLENE	3
CHEMICAL	SAMPLED	POS.		

# SOLANO

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
1,1,2,2-TETRACHLOROETHANE	7		DIELDRIN		1
1,2,4-TRICHLOROBENZENE	7		DINOSEB		2
1,2-D + 1,3-D + C-3 COMPOUNDS	7		DIQUAT DIBROMIDE		2
1,2-DICHLOROPROPANE (1,2-D)	7		ENDOTHALL		2
2,3,7,8-TCDD (DIOXIN)	1		ENDRIN		2
2,4,5-TP (SILVEX)	2		ETHYLENE DIBROMIDE		1
2,4-D	2		GLYPHOSATE, ISOPROPYLAMINE		2
3-HYDROXYCARBOFURAN	2		SALT		
ALDICARB	2		HEPTACHLOR		2
ALDICARB SULFONE	2		HEPTACHLOR EPOXIDE		2
ALDICARB SULFOXIDE	2		HEXACHLOROBENZENE		2
ALDRIN	2		LINDANE (GAMMA-BHC)		2
BENTAZON, SODIUM SALT	2		METHOMYL		2
BENZENE	8	1	METHOXYCHLOR		2
CARBARYL	2		METHYL BROMIDE		7
CARBOFURAN	2		NAPHTHALENE		7
CHLORDANE	2		ORTHO-DICHLOROBENZENE		7
CHLOROMETHANE	7		OXAMYL		1
CHLOROTHALONIL	2		PICLORAM		2
DALAPON	1		TOXAPHENE		2
DBCP	1		TRICHLOROBENZENES		7
DICAMBA	2		XYLENE		7



Appendix A part 2 continued: Counties with any positive detections. The chemical, number of wells sampled, and number of wells with positive detections is given.

SONOMA

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
1,1,2,2-TETRACHLOROETHANE	6		DIMETHOATE	7	
1,2,4-TRICHLOROBENZENE	6		DINOSEB	9	
1,2-D + 1,3-D + C-3 COMPOUNDS	6		DIQUAT DIBROMIDE	10	
1,2-DICHLOROPROPANE (1,2-D)	7	1	DIURON	2	
2,4,5-TP (SILVEX)	11		ENDOTHALL	12	
2,4-D	11		ENDRIN	12	
3-HYDROXYCARBOFURAN	8		ETHYLENE DIBROMIDE	11	
ALACHLOR	4		HEPTACHLOR	12	
ALDICARB	8		HEPTACHLOR EPOXIDE	12	
ALDICARB SULFONE	8		HEXACHLOROBENZENE	3	
ALDICARB SULFOXIDE	8		LINDANE (GAMMA-BHC)	12	
ALDRIN	4		METHOMYL	8	
ATRAZINE	17		METHOXYCHLOR	12	
BENTAZON, SODIUM SALT	4		METHYL BROMIDE	6	
BENZENE	7	1	METOLACHLOR	7	
BROMACIL	7		METRIBUZIN	7	
BUTACHLOR	7		MOLINATE	7	
CARBARYL	6		NAPHTHALENE	6	
CARBOFURAN	8		ORTHO-DICHLOROBENZENE	6	
CHLORDANE	12		OXAMYL	10	
CHLOROMETHANE	6		PICLORAM	14	
CHLOROTHALONIL	9		PROMETRYN	7	
DALAPON	13		PROPACHLOR	8	
DBCP	6		SIMAZINE	17	
DIAZINON	7		THIOBENCARB	7	
DICAMBA	4		TOXAPHENE	12	
DIELDRIN	5		TRICHLOROBENZENES	6	
			XYLENE	6	



Appendix A part 2 continued: Counties with any positive detections. The chemical, number of wells sampled, and number of wells with positive detections is given.

STANISLAUS

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
1,1,2,2-TETRACHLOROETHANE	6		DINOSEB	14	
1,2,4-TRICHLOROBENZENE	6		DIQUAT DIBROMIDE	14	
1,2-D + 1,3-D + C-3 COMPOUNDS	6		DIURON	25	1
1,2-DICHLOROPROPANE (1,2-D)	6		ENDOTHALL	14	
2,4,5-TP (SILVEX)	2		ENDRIN	1	
2,4-D	2		ETHYLENE DIBROMIDE	28	1
3-HYDROXYCARBOFURAN	15		GLYPHOSATE, ISOPROPYLAMINE	1	
ACET	9	1	SALT		
ALACHLOR	1		HEPTACHLOR	2	
ALDICARB	15		HEPTACHLOR EPOXIDE	2	
ALDICARB SULFONE	15		HEXACHLOROBENZENE	1	
ALDICARB SULFOXIDE	15		HEXAZINONE	9	1
ALDRIN	2		LINDANE (GAMMA-BHC)	1	
ATRAZINE	24		METHOMYL	15	
BENTAZON, SODIUM SALT	2		METHOXYCHLOR	2	
BENZENE	6		METHYL BROMIDE	6	
BROMACIL	10		METOLACHLOR	15	
BUTACHLOR	15		METRIBUZIN	26	
CARBARYL	15		MOLINATE	15	
CARBOFURAN	15		NAPHTHALENE	6	
CHLORDANE	1		NORFLURAZON	4	
CHLOROMETHANE	6		ORTHO-DICHLOROBENZENE	6	
CHLOROTHALONIL	2		OXAMYL	15	
CYANAZINE	9		PICLORAM	14	
DALAPON	14		PROMETON	9	
DBCP	30	5	PROMETRYN	10	
DEETHYL-ATRAZINE	9		PROPACHLOR	1	
DIAZINON	1		SIMAZINE	24	
DICAMBA	14		THIOBENCARB	1	
DIELDRIN	2		TOXAPHENE	1	
DIMETHOATE	14		TRICHLOROBENZENES	6	
			XYLENE	6	



Appendix A part 2 continued: Counties with any positive detections. The chemical, number of wells sampled, and number of wells with positive detections is given.

# TULARE

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
1,1,2,2-TETRACHLOROETHANE	22		DIELDRIN	22	
1,2,4-TRICHLOROBENZENE	22		DIMETHOATE	40	
1,2-D + 1,3-D + C-3 COMPOUNDS	22		DINOSEB	8	
1,2-DICHLOROPROPANE (1,2-D)	23	1	DIQUAT DIBROMIDE	2	
2,4,5-TP (SILVEX)	8		DIURON	66	12
2,4-D	8		ENDOTHALL	2	
3-HYDROXYCARBOFURAN	5		ENDRIN	22	
ACET	39	23	ETHYLENE DIBROMIDE	83	
ALACHLOR	32		HEPTACHLOR	22	
ALDICARB	5		HEPTACHLOR EPOXIDE	22	
ALDICARB SULFONE	5		HEXACHLOROBENZENE	22	
ALDICARB SULFOXIDE	5		HEXAZINONE	24	
ALDRIN	22		HYDROXYSIMAZINE	20	
ATRAZINE	66		LINDANE (GAMMA-BHC)	22	
BENTAZON, SODIUM SALT	8		METHOMYL	5	
BENZENE	22		METHOXYCHLOR	22	
BROMACIL	72	11	METHYL BROMIDE	22	
BUTACHLOR	42		METOLACHLOR	42	
CARBARYL	5		METRIBUZIN	66	
CARBOFURAN	5		MOLINATE	42	
CHLORDANE	22		NAPHTHALENE	22	
CHLOROMETHANE	22		NORFLURAZON	24	1
CHLOROTHALONIL	5		ORTHO-DICHLOROBENZENE	22	
CYANAZINE	24		OXAMYL	5	
DALAPON	8		PICLORAM	8	
DBCP	83	28	PROMETON	24	
DEETHYL-ATRAZINE	25	8	PROMETRYN	66	
DEETHYLHYDROXYSIMAZINE	20		PROPACHLOR	30	
DACT	26	18	SIMAZINE	90	29
DIAMINOHYDROXYTRIAZINE	20		THIOBENCARB	40	
DIAZINON	42		TOXAPHENE	22	
DICAMBA	8		TRICHLOROBENZENES	22	
			XYLENE	22	2





Appendix A part 2 continued: Counties with any positive detections. The chemical, number of wells sampled, and number of wells with positive detections is given.

# VENTURA

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
1,1,2,2-TETRACHLOROETHANE	24		DINOSEB	15	
1,2,4-TRICHLOROBENZENE	24		DIQUAT DIBROMIDE	16	
1,2-D + 1,3-D + C-3 COMPOUNDS	24		DIURON	5	
1,2-DICHLOROPROPANE (1,2-D)	24		ENDRIN	14	
2,4,5-TP (SILVEX)	15		ETHYLENE DIBROMIDE	17	
2,4-D	16		GLYPHOSATE, ISOPROPYLAMINE	5	
3-HYDROXYCARBOFURAN	12		SALT		
ALACHLOR	12		HEPTACHLOR	14	
ALDICARB	12		HEPTACHLOR EPOXIDE	14	
ALDICARB SULFONE	12		HEXACHLOROBENZENE	14	
ALDICARB SULFOXIDE	12		LINDANE (GAMMA-BHC)	12	
ALDRIN	14		METHOMYL	13	
ATRAZINE	16		METHOXYCHLOR	14	
BENTAZON, SODIUM SALT	15		METHYL BROMIDE	24	
BENZENE	24		METOLACHLOR	13	
BROMACIL	13		METRIBUZIN	13	
BUTACHLOR	13		MOLINATE	13	
CARBARYL	14		NAPHTHALENE	28	
CARBOFURAN	12		ORTHO-DICHLOROBENZENE	24	
CHLORDANE	14		OXAMYL	14	
CHLOROMETHANE	24		PARAQUAT DICHLORIDE	4	
CHLOROTHALONIL	10		PICLORAM	16	
DALAPON	15		PROMETRYN	15	
DBCP	19		PROPACHLOR	12	
DIAZINON	15		SIMAZINE	16	
DICAMBA	15		THIOBENCARB	13	
DIELDRIN	14		TOXAPHENE	12	
DIMETHOATE	15		TRICHLOROBENZENES	24	
			XYLENE	25	1

# YUBA

CHEMICAL	SAMPLED	POS.	CHEMICAL	SAMPLED	POS.
1,1,2,2-TETRACHLOROETHANE	6		DICAMBA	2	
1,2,4-TRICHLOROBENZENE	6		DINOSEB	2	
1,2-D + 1,3-D + C-3 COMPOUNDS	5		DIURON	2	
1,2-DICHLOROPROPANE (1,2-D)	6		METHYL BROMIDE	5	
2,4,5-TP (SILVEX)	2		ORTHO-DICHLOROBENZENE	6	
2,4-D	2		PICLORAM	2	
BENTAZON, SODIUM SALT	2	1	SIMAZINE	2	
BENZENE	6	1	TRICHLOROBENZENES	5	
CHLOROMETHANE	5		XYLENE	6	
CHEMICAL	SAMPLED	POS.			



## **Appendix B**

### **Studies Included in the 1997 Update Report**

The well sampling surveys that were added to the well inventory database during the period July 1, 1996 - June 30, 1997 are summarized. The study number assigned by DPR is shown to the left.

#### **CALIFORNIA DEPARTMENT OF HEALTH SERVICES (Sanitary Engineering Branch)**

0023      Sampled a total of 109 chemicals in 43 counties; January 1996 - December 1996; 2,204 wells sampled.

#### **REGIONAL WATER QUALITY CONTROL BOARD- SAN FRANCISCO**

385      Sampled for 68 chemicals in 9 wells in Napa County. June, 1994. Unverified detections were made of methylele chloride and methyl bromide. Follow-up by DPR on methyl bromide detections was reported in the 1996 well inventory report; methyl bromide was not detected.

#### **DEPARTMENT OF WATER RESOURCES - NORTHERN DISTRICT**

389      Sampled 61 chemicals in 33 wells in Humboldt County; June 1994. No detections  
414      Sampled 68 chemiclas in 13 wells; Siskiyou and Modoc counties; July 1996. No detections.

#### **SANTA CLARA VALLEY WATER DISTRICT**

390      Sampled for 22 chemiclas in 20 wells in Santa Clara County; 1991 and 1995. No detections.

#### **USDA FOREST SERVICE**

401      Sampled for and detected hexazinone in 1 well in Calaveras County. March - May 1995.  
402      Sampled for hexazinone in 2 wells in Tuolumne County. March - April 1996. No detections.  
403      Sampled for hexazinone in 3 wells in Mariposa and Madera counties. March 1993. No detections.

#### **STOCKTON EAST SAN JOAQUIN WATER DISTRICT**

404      Sampled for DBCP, EDB, 1,2-D, and 1,3-dichloropropene in 8 wells in San Joaquin County. December 1989. DBCP was detected in 3 wells.

#### **CITY OF SAN FRANCISCO**

406      Sampled for 26 chemicals in 11 wells in San Francisco County. November - December 1993. No detections.

#### **CIGA-GIEGY / CIBA CROP PROTECTION**

408      Sampled for simazine, deethylsimazine, diaminochlorotriazine, hydroxysimazine, deethylhydroxysimazine, and diaminohydroxytriazine in 27 wells in Fresno and Tulare counties. Numerous detections were made of simazine, deethylsimazine, and diaminochlorotriazine. September 1993 - May 1995.



**DEPARTMENT OF PESTICIDE REGULATION** (Environmental Hazards Assessment Program)

Analyses were performed for the listed chemicals.

**Bold** indicates the chemical(s) for which the study was initiated.

Underline indicates a verified detection of the chemical was made.

- 393      Bromacil, DACT, DES, diuron, simazine; 24 wells in Fresno County, 6 wells in Tulare County; July - August 1996; Study 146: Ages and Types of Triazine Residues in Fresno and Tulare Counties, California
- 394      Atrazine, **bromacil**, cyanazine, ACET, DEA, diuron, hexazinone, metribuzin, prometon, prometryn, simazine; Monterey County; July - August 1996; 3 wells.
- 395      Atrazine, bromacil, cyanazine, ACET, DEA, diuron, hexazinone, metribuzin, prometon, prometryn, **simazine**; Sutter County; June 1996; 4 wells.
- 396      Atrazine, bromacil, cyanazine, ACET, DEA, diuron, hexazinone, metribuzin, prometon, prometryn, simazine; Mendocino County; June 1996; 5 wells.
- 397      **Atrazine**, **bromacil**, cyanazine, ACET, DEA, diuron, hexazinone, metribuzin, prometon, prometryn, simazine; San Joaquin County; August, November 1996; 20 wells.
- 398      **Atrazine**, bromacil, cyanazine, ACET, DEA, diuron, hexazinone, metribuzin, prometon, prometryn, simazine; Monterey County; July 1996; 4 wells.
- 399      Atrazine, **bromacil**, cyanazine, ACET, DEA, diuron, hexazinone, metribuzin, prometon, prometryn, simazine; Butte County; August 1996; 4 wells.
- 400      **Atrazine**, bromacil, cyanazine, ACET, DEA, diuron, hexazinone, metribuzin, prometon, prometryn, simazine; Butte County; July 1996; 3 wells.
- 405      Atrazine, bromacil, cyanazine, ACET, DEA, diuron, hexazinone, metribuzin, prometon, prometryn, **simazine**; Sutter County; June 1996; 1 well.
- 407      Ground Water Protection List Monitoring. Atrazine, bromacil, cyanazine, ACET, DEA, diuron, hexazinone, metribuzin, **norflurazon**, prometon, prometryn, simazine; Fresno, Kern, Madera, Merced, San Joaquin, Stanisluas, Tulare counties; August 1996; 40 wells.
- 409      Atrazine, bromacil, cyanazine, ACET, DEA, diuron, hexazinone, metribuzin, **norflurazon**, prometon, prometryn, simazine; Tulare County; Oct - Nov. 1996; 14 wells.



- 410      Atrazine, bromacil, cyanazine, ACET, DEA, diuron, hexazinone, metribuzin, **norflurazon**, prometon, prometryn, simazine; Fresno County Oct - Dec 1996; 31 wells. Norflurazon entered into AB2021 detection response process.
- 411      Atrazine, **bromacil**, cyanazine, ACET, DEA, diuron, hexazinone, metribuzin, prometon, prometryn, simazine; San Joaquin County; August 1996; 4 wells.
- 412      Atrazine, bromacil, cyanazine, ACET, DEA, diuron, **hexazinone**, metribuzin, prometon, prometryn, simazine; Stanislaus County; November 1996; 5 wells.
- 413      Atrazine, bromacil, cyanazine, ACET, DEA, diuron, **hexazinone**, metribuzin, prometon, prometryn, simazine; Calaveras County; October 1996; 5 wells.
- 415      Atrazine, bromacil, **chlorthal-dimethyl (dacthal)**, cyanazine, diuron, hexazinone, metribuzin, MTP, norflurazon, prometon, prometryn, simazine, TPA; Madera County; July 1996 - January 1997; 7 wells.

A well sampling study was not conducted for the following detections because an investigation of the detections was conducted according to the "Revised protocol for selecting sampling areas and wells in a four-section survey to locate a second positive well site". Based on the investigation, PMZs were recommended.

- Z352      Simazine, DIPA (now called ACET) ; Fresno County. Based on the investigation, section 13S/21E-21 should be declared a PMZ for atrazine and simazine.





## Appendix C

### Analytical Methods for the Verification of Ground Water Contamination by Pesticides

#### VERIFICATION

All reports of pesticide residues in ground water are considered verified after the following has occurred:

1. A finding results from an analytical method approved by the department that provides unequivocal identification of a chemical, or,
2. Two discrete samples from the same site have been taken by the Department, no longer than 30 days apart, and
  - (a) the residue has been detected by one laboratory using different analytical methods approved by the Department, or
  - (b) the residue has been detected by two different laboratories using an analytical method approved by the Department

If only a degradation product of the substance under investigation is subsequently detected, then the degradation product itself must be detected in a second discrete sample.

#### Definition of Different Analytical Methods

Confirmation of a residue by a second analytical method is intended to increase the confidence in the positive detection of a chemical by the first analytical method. If the measurement procedures of the second method vary only slightly from the first method, it is likely that an erroneous identification in the first determination would also occur in the second. Therefore, the second method should be based on separation and/or detection processes as different from the first method as feasible.

The minimum changes needed in the first method to qualify it for consideration as a second method depend on the specificity of both methods. The following matrix lists the possible combinations where *detection and separation* is defined as a significant change in both detector and separation procedure, *detection* is a significant change in the detector only, and *detection or separation* is a significant change in the detector or separation procedure.

***Minimum requirements for procedural changes  
in a first method to qualify it as a second method:***

#### SECOND METHOD

#### FIRST METHOD

#### *specific*

#### *non-specific*

#### *specific*

detection & separation

detection

#### *non-specific*

detection

detection or separation



### **Specific Methods**

A specific method provides positive identification of the measured chemical. This unequivocal identification implies that the detection system can distinguish the target compound from all other compounds in a given mixture, with or without the need for an additional separation procedure. A method is also considered to be specific if all known interferences yield insignificant responses; i.e., the sensitivity for the interfering compound is less than 0.1 percent of the sensitivity for the target compound.

Examples for specific methods are spectroscopic techniques like mass spectroscopy (MS) and Fourier transform infrared (FTIR) spectroscopy, which are generally used together with separation techniques like gas chromatography (GC) or high performance liquid chromatography (HPLC).

### **Nonspecific Methods**

All methods that respond to more than one chemical and which use detectors that cannot distinguish between these different chemicals are considered to be nonspecific. Analytical methods that incorporate nonspecific detectors rely completely on separation procedures for identification. The problem with nonspecific detectors is that they can only prove the absence of a chemical when no signal is registered at the proper conditions for the chemical in question. When a signal is measured, however, one can only say that it is likely that the signal is caused by that chemical. But it is not a proven fact, as another component of the unknown mixture might interfere and the detector cannot distinguish between the two.

This definition of nonspecific includes the majority of GC techniques. For example, nitrogen-phosphorus specific detectors used in GC analysis are specific only on the atomic level; they can distinguish nitrogen and phosphorus atoms from other atoms, but they cannot distinguish between one nitrogen-containing chemical and another.

### **Significant Change**

A significant change in detector means a change in detection principle (for GC, a change from a flame photometric detector [FPD] to a conductivity detector, for example). A significant change in the separation procedure is either a change in separation principle (from GC to HPLC, for example) or a change in the separation condition (i.e., using a different type of column), as long as this change will alter the sequence in which the compounds are registered.

Following are examples for the three types of minimum changes (detection and separation, detection only, and detection or separation), given in the previous matrix, that qualify as significant changes:



#### *Case 1*

When both the first and the second method are nonspecific, both the detector and the separation procedure have to be changed significantly. For example, a first method using GC separation and a FPD could use as a second method either a GC with a significantly different column and a nitrogen-phosphorus detector (changing separation conditions and detector) or an HPLC separation with a UV-detector (changing separation principle and detector).

#### *Case 2*

When only one of the methods is specific, just the detection principle has to be changed; the separation procedure may be kept the same (GC/FPD and GC/MS using the same column, for example).

#### *Case 3*

When both methods are specific, either the detector or the separation procedure may be changed. Examples for these cases are GC/MS and HPLC/MS (keeping the same detector) or GC/MS and GC/FTIR (keeping the same separation conditions).

In cases (2 and 3) where only a change in detector is needed, it is acceptable to use an integrated system where the effluent of the separation step is split and routed to two detectors. An example for this is GC/MS/FTIR, where the effluent of the GC is analyzed by MS and FTIR simultaneously. As this integrated analytical instrument uses two specific detectors, it counts as both a first and second method.

### **Screening Methods**

Special consideration has to be given to qualitative or semi-quantitative methods typically used for screening. Qualitative methods yield only detected/not detected results; semi-quantitative methods indicate the order of magnitude for the concentration of the identified chemical. Samples identified as positive will be forwarded for analysis by a quantitative method.

In this case, the qualitative screen is considered to be the first method. The quantitative method is then selected based on the above criteria for a second method. A second quantitative method (i.e., a third analysis method) is required only when verification is needed not only for the identity of the compound but also for its concentration. Analogously, a qualitative method may be used as a second method if verification of the concentration is not required. A qualitative method cannot be used as a second method when the first method is qualitative.

For example: a specific enzyme-linked immunosorbent assay (ELISA) may be used as a first method, even if it is used just as a detected/not detected screen. A nonspecific ELISA qualifies as a second detector for the effluent from an HPLC. Note, however, that any ELISA which shows significant cross-reactivity to other compounds is considered to be nonspecific and would also require a change in the separation procedure.



### **Unequivocal Detection Methods**

The basic requirement for an unequivocal detection is that the target compound can be distinguished from potential interferences present in an environmental sample. This can be achieved by two routes:

- a) The method is known not to show any significant interferences from other chemicals. Example: an enzyme-linked immunosorbent assay (ELISA) that has been tested for cross-reactivity.
- b) The method uses a detection process that can be used to identify the chemical structure of the compound. Example: mass spectroscopy (MS) or infrared (IR) spectroscopy.

Any method that does not meet the above criteria will require a confirmation analysis by a second method or a second laboratory. Detection methods that meet the above criteria are likely to provide unequivocal detections, but this is influenced by the operating conditions and the nature of the chemical analyzed. Even though these detection methods provide the capability to identify a chemical, it does not imply that they will be able to do so unequivocally under all operating conditions or for all chemicals. Therefore, the determination as to whether a given analysis method can be considered unequivocal will not be based generically on the detection method used, but must be made on a case-by-case basis in consultation with the chemistry laboratory. Only the explicit operating instructions contained in a written and approved method, together with the supporting data of the method validation, will provide enough information to make a determination. A specific analysis method will only be recommended to the branch chief as an unequivocal method according to AB 2021 if both the chemist in charge of the method development and the senior environmental research scientist assigned to the project sign off on this designation.





## **Appendix D**

### **Methods Used for Collection, Verification, and Entry of Data**

#### **METHODS**

##### **Data Collection**

Section 13152, subdivision (c) of the PCPA requires all government agencies that sample wells for pesticides to submit their sampling data to DPR for inclusion in the well inventory database. DPR has notified agencies of this law and requested them to submit required information. DPR has also contacted private companies that conduct well sampling for pesticides to request sampling results.

Data were reviewed to determine if they met the criteria for inclusion in the database:

- Results were for the analyses of pesticides or pesticide breakdown products;
- Samples were taken from a well;
- Samples were obtained from an untreated and unfiltered system;
- Location of each well was identified by at least township/range/section according to the U.S. Geological Survey's Public Lands Survey Coordinate system;
- Data had not previously been entered into the database.

The PCPA also requires DPR, the SWRCB, and CDHS to jointly establish minimum requirements for well sampling that will help insure data integrity. The agencies agreed upon the following minimum reporting requirements, effective December 1, 1986: State well number, County, date of sample, chemical analyzed for, chemical concentration, minimum detectable limit, sampling agency, analyzing laboratory, street address of well location, well type, sample type (initial or confirmation).

Information included in the data base when it is available includes: method of analysis and analysis date, well depth and depths of top and bottom perforations of the well casing, depth of standing water in the well at time of sampling, year the well was drilled



### **Data Verification and Entry into the Permanent Database**

Each laboratory analysis of a well water sample for the presence of a pesticide active ingredient or breakdown product comprises one record in the database. This record of sampling information can be supplemented with any available well location and construction information. Before being added to the permanent well inventory database, each record undergoes verification by programs developed by DPR staff. All data errors are corrected. An explanation of the major verification procedures follows.

#### **Township/range/section (T/R/S) verification:**

The townships, ranges, and sections assigned to each county by the U.S. Geological Survey's Public Lands Survey Coordinate System were entered into a reference database. A computer program compares each new record's township, range, and section against the reference database.

#### **Base Meridian verification:**

Six counties in California (Kern, San Luis Obispo, Trinity, Inyo, Siskiyou, and San Bernardino) are intersected by the Public Lands Survey baseline/meridian boundaries. Data for a single well reported with different base meridians but under the same well number would exist as two unique wells in the database. This program examines the township and range for each well number to verify that the base meridian is valid.

#### **Unique Address verification:**

The well location address for each new record is checked against existing well location information for that well number. Each well must have a unique well number and address.



## Appendix E

### Glossary of Terms

**AB 1803** – (1983) A law that required the California Department of Health Services (DHS) to evaluate each public water system to determine its potential for contamination. The systems were required to conduct specified water analyses and to report those results to the DHS. Monitoring required by AB 1803 was completed in June 1989. Based on sampling results, the DHS may require a system to conduct periodic water analyses and to report to the DHS the results of the analyses.

**AB 2021** – See *Pesticide Contamination Prevention Act*.

**active ingredient** – The chemical or chemicals in a pesticide formulation that are in themselves, or are transformed to chemicals that are capable of preventing, destroying, repelling or mitigating pests.

**Agricultural commissioner** – For each county in California, the person in charge of the County Department of Agriculture. Under the supervision of DPR, the commissioner enforces the laws and regulations pertaining to agricultural and structural pest control and all other pesticide uses.

**agricultural use** – (See also *legal agricultural use* and *legal agricultural use determination*.) The use of any pesticide or method or device for the control of any pests, or the use of any pesticide for the regulation of plant growth or defoliation of plants. It excludes the sale or use of pesticides in properly labeled packages or containers which are intended only for any of the following: home use, use in structural pest control, industrial or institutional use, the control of an animal pest under the written prescription of a veterinarian, local districts, or other public agencies which have entered into and operate under a cooperative agreement with the Department of Health Services pursuant to section 2426 of the Health and Safety Code. (Food and Agricultural Code, section 11408.)

**analysis** – The determination of the composition of a substance by analytical methods. For example, the separation and measurement of a pesticide or its degradation product from the sample matrix.

**aquifer** – A geologic formation that is water bearing and which transmits water in sufficient quantity to supply springs and pumping wells.

**Birth Defect Prevention Act (BDPA)** – (SB 950, 1984) A law requiring DPR to acquire certain toxicological data for registered pesticides in order to make a scientific determination that their uses will not cause significant adverse health effects. The BDPA prohibits the registration of any new pesticide active ingredient if required mandatory health effects studies are missing, incomplete, or invalid. Pesticide active ingredients already registered that are identified as having the potential to cause significant adverse health effects following a thorough review by DPR scientific staff will be canceled.

**breakdown product** – See *degradation product*.

**Cal/EPA** - California Environmental Protection Agency. Comprised of the Department of Pesticide Regulation, the Department of Toxic Substances Control, the Integrated Waste Management Board,



the Water Resources Control Board, the Air Resources Board, and the Office of Environmental Health Hazard Assessment.

**CCR (3CCR)** - California Code of Regulations. Title 3, California Code of Regulations (3CCR). California Code of Regulations contains enforceable regulations that provide the specific means for implementation of laws. Title 3 CCR contains regulations pertaining to food and agriculture, including sale and use of pesticides.

**chemigation** – The application of pesticides through irrigation water, using irrigation equipment.

**confirmed detection** – For purposes of the well inventory database, the detection of a compound in two discrete samples taken from the same well during the time period of a single monitoring survey.

**database record** – The results of each chemical analysis of a well water sample for a pesticide residue and other corresponding sampling information constitutes one record in the database.

**degradation product** – A substance resulting from the transformation of a pesticide active ingredient by physical or chemical processes (e.g., oxidation, reduction, hydrolysis, photolysis).

**direct streaming** – A pathway by which agricultural chemicals may reach ground water; the movement of pesticide residue in runoff surface water to subsurface soil and, ultimately, ground water, through dry wells, soil cracks, or other direct pathways.

**discrete sample** – Samples taken separately from a well; not one sample split into smaller samples.

**dry well** – A small-diameter hole or pit dug into the ground and filled with gravel or other material for the disposal of surface water by infiltration into soil.

**economic poison** – see pesticide.

**established PMZ** – A *pesticide management zone* (PMZ) listed in section 6802, Title 3 of the California Code of Regulations (3CCR).

**FAC** - Food and Agricultural Code. The laws pertaining to food and agriculture, including the registration, sale, and use of pesticides. Specific regulations for implementation of law are in the *California Code of Regulations*.

**formulation** – The way in which a pesticide product, containing the active ingredient, the carrier, and other additives, is prepared for use. Includes wettable powder, emulsifiable concentrate, etc.

**fumigant** – A chemical used in the form of a volatile liquid or a gas. Its vapors kill insects, nematodes, fungi, bacteria, seeds, roots, or entire plants; usually applied in an enclosure or in the soil.

**ground water** – Water beneath the surface that can be collected with wells, tunnels, or drainage galleries, or that flows naturally to the earth's surface via seeps or springs.

**Ground water protection advisories (GWPA)** – Written information given by a licensed pest control adviser, who has successfully completed the Ground Water Protection Training Program given by DPR, that must be submitted by permit applicants before the county agricultural commissioner can





issue a use permit for allowed uses of a regulated pesticide in a pesticide management zone (PMZ). The GWPA contains specific information for applying the regulated pesticide in a sensitive area (PMZ) in order to prevent or minimize the movement of pesticide residues to ground water.

**Groundwater Protection List (GWPL)** – A list of pesticides having the potential to pollute ground water. It is required by the PCPA and established in section 6800 (3CCR). The GWPL is divided into two sublists. Sublist (a) is comprised of chemicals that have been detected in ground water as a result of legal, agricultural use. Sublist (b) contains pesticide active ingredients whose physico-chemical properties exceed or are less than the *specific numerical values* and that are labeled for soil application under certain conditions. Chemicals placed on the GWPL are subject to certain restrictions and reporting requirements.

**herbicide** – A pesticide used to control unwanted vegetation.

**historical agricultural use** – The documented use of a chemical, no longer registered for such use, that has been applied over time in a specific area for the production of an agricultural commodity.

**hydrolysis** – The chemical alteration of a pesticide by water.

**initial detection sample** – For a single study and a particular well, the initial detection sample for a chemical is the positive sample with the earliest sampling date and/or time. Subsequent samples are coded in relation to the initial detection sample.

**insecticide** – A pesticide used to kill insects.

**institutional use** – Use within the confines of, or on property necessary for the operation of, buildings such as hospitals, factories, schools, libraries, auditoriums and office complexes.

**law** – State laws and statutes are the result of action by the California legislature.

**leaching** – A pathway by which agricultural chemicals may reach ground water; the process by which pesticides carried by water, either in the dissolved or suspended state, through the soil matrix as it recharges a ground water aquifer.

**legal agricultural use** – The application of a pesticide, according to label directions and in accordance with federal and state laws and regulations, for agricultural use as defined in Food and Agricultural Code, section 11408. (See *agricultural use*.)

**legal agricultural use determination** – A determination required by Food and Agricultural Code (FAC) section 13149 and based upon the following criteria: (1) the detection of a pesticide ingredient or its degradation product that has been verified according to DPR criteria; (2) a detection of the same pesticide ingredient or its degradation product in ground water, verified at a second site in either an adjacent section or within one-half mile radius of the original, verified detection; (3) the detected pesticide ingredient must be formulated in a product which has listed on its label one or more agricultural uses; (4) the application of the agricultural use product(s) in the vicinity of the reported detections should either be documented historically, confirmed by local interviews, or presumed by the identification of a target pest or commodity; (5) the Director may consider a preponderance of evidence as meeting these criteria.



**maximum contaminant level (MCL)** – MCLs are part of the drinking water quality standards adopted by DHS and by U.S. EPA under the Safe Drinking Water Act. MCLs are formally established in regulation and are enforceable by the DHS on water suppliers. Primary MCLs take into consideration both health-based criteria and technologic and economic factors relating to the ability to achieve and monitor these concentrations in drinking water supply systems.

**metabolite** – In the case of a pesticide, a compound derived from the action upon the pesticide by a living organism (bacteria, plant, insect, higher animal, etc.). The chemical transformation varies (oxidation, reduction, conjugation) and the metabolite may be more toxic or less toxic than the parent compound. The same derivative may, in some cases, develop through exposure of the pesticide in the environment. (See also *degradation product*.)

**minimum detection limit (MDL)** – The lowest concentration of analyte that a method of analysis can reliably quantify. The MDL is established in protocol for a study either as a result of a method validation study or by using accepted proven analytical methods (e.g., U.S. EPA methods).

**model** – Mathematical equations that represent certain processes. These equations can be implemented in a computer program in order to facilitate calculations and test model predictions against measured data.

**monitoring study** – See *survey*.

**monitoring well** – Any artificial excavation by any method for the purpose of monitoring fluctuations in ground water levels, quality of underground waters, or the concentration of contaminants in underground waters.

**non-crop areas** – These areas include rights-of-way, golf courses, and cemeteries. There may be agricultural use of pesticides in non-crop areas, e.g., for weed control around buildings on a farm.

**non-point source** – Contamination which cannot be traced to a small, definable location (compare with *point source*), e.g., applications of agricultural chemical to crops.

**parts per billion (ppb)** – A way to express the concentration of a chemical. One microgram of a chemical in one liter of water is equal to one ppb.

**permit** – Permits are issued by county agricultural commissioners for the use of chemicals that have been designated as restricted pesticides. Restricted pesticides, for various reasons, are potentially more hazardous than other pesticides.

**pest** – Any of the following that is, or is liable to become, dangerous or detrimental to the agricultural or nonagricultural environment of the State: any insect, predatory animal, rodent, nematode, or weed; any form of terrestrial, aquatic, or aerial plant or animal, virus, fungus, bacteria, or other microorganisms on or in living humans or other living animals; anything that the Director of the California Department of Food and Agriculture or Director of the Department of Pesticide Regulation declares, by regulation, to be a pest.

**Pest Control Adviser (PCA)** – A person licensed by DPR and registered with the county agricultural commissioner who makes pest control recommendations. All agricultural use recommendations must



be in writing and contain certain information. A PCA must complete continuing education requirements before his/her license may be renewed.

**pesticide** – In California, any of the following: any spray adjuvant, any substance, or mixture of substances which is intended to be used for defoliating plants, regulating plant growth, or for preventing, destroying, repelling, or mitigating any pest which may infest or be detrimental to vegetation, man, animals, or households, or be present in any agricultural or nonagricultural environment. Includes fungicides, herbicides, insecticides, nematocides, rodenticides, desiccants, defoliant, plant growth regulators.

**Pesticide Contamination Prevention Act (PCPA)** – (AB 2021) A law, effective January 1, 1986, which added sections 13141 through 13152 to Division 7 of the FAC. The PCPA requires each registrant of an economic poison to submit specified information to the Director of DPR, provides for the establishment of the Groundwater Protection List, requires the Director to perform soil and water monitoring, provides for a specific response to the detection of pesticides in soil and ground water, and requires the Director to maintain a specified well sampling database and to report certain information annually to the Legislature, the DHS, and the State Water Resources Control Board.

**Pesticide Detection Response Process (PDRP)** – A process, established in sections 13149 through 13151 (FAC) by the PCPA, in which the detection of a pesticide residue in soil (at specific depths) or ground water, is investigated, evaluated, and, when necessary, mitigated. As part of the process, a determination must be made that the detection probably resulted from a legal agricultural use application of the pesticide. As a result of this process, the use of a pesticide in California may be modified or canceled.

**pesticide management zone (PMZ)** – A geographic surveying unit of approximately one square mile (a section) that is designated in regulation as sensitive to ground water pollution. The use of a pesticide inside its PMZ is subject to certain ground water protection restrictions and requirements.

**pesticide residue** – The amount of a pesticide active ingredient remaining in a soil or ground water sample at the time of analysis.

**physicochemical properties** – The types of behavior that a substance exhibits in chemical reactions are called its chemical properties; other characteristics that are typical of a substance are called its physical properties. Taken together, the chemical and physical properties of a substance are called its physicochemical properties.

**point source** – A source of contamination, such as a spill or at a waste site, that is initially deposited and concentrated in a small, well-defined area. The contamination can be traced to its point of origin by locating a specifically shaped pattern in the ground water called a plume.

**positive detection** – A well water sample in which the presence of a pesticide chemical is detected at or above the minimum detection limit of the analytical method used for analysis of the compound under investigation. A positive analysis may be designated as confirmed or unconfirmed.

**range** – A single series or row of townships, each six miles square, extending parallel to, and numbered east and west from, a survey base meridian line. (See *well numbering system*.)



**recommended PMZ** – A section of land (one square mile) identified by DPR as sensitive to ground water pollution by specific pesticides, not yet adopted into regulation in section 6802 (3CCR).

**registered pesticide** – A pesticide product approved by the USEPA and DPR for use in California.

**registrant** – A person or corporation that has registered an economic poison for use in California and has obtained a certificate of registration from the Department.

**regulation** – These are adopted by state agencies to implement or clarify statutes enacted by the California Legislature. They can also be adopted in response to federal legislation, court decisions, changing technologies, and concerns for the health and well-being of the residents of California.

**related compounds** – See *degradation product* and *metabolite*.

**restricted material** – Compounds designated as “restricted materials” in section 6400 (3CCR) that, for various reasons, are potentially more hazardous to people, animals, or the environment than other pesticides. As a result, the use of these materials is regulated more closely and use is permitted only by trained personnel when additional precautionary measures are taken.

**right-of-way** – The strip of land over which facilities such as highways, or railroads are built.

**section** – A land unit of 640 acres (one square mile) equal to 1/36 of a township. (See *well numbering system*.)

**soil adsorption coefficient (Koc)** – A measure of the tendency of compounds such as pesticide active ingredients to adhere to the surfaces of soil particles.

**specific numerical values (SNVs)** – Certain numeric threshold values set for the following physical and chemical properties of pesticide active ingredients: water solubility, soil adsorption coefficient, hydrolysis, aerobic and anaerobic soil metabolism, and field dissipation. The PCPA associates these properties with the longevity and mobility of a chemical in the soil and requires the establishment of SNVs in regulation as a means of identifying pesticides with the potential to pollute ground water.

**State Well Number** – See *well numbering system*.

**survey** – In the context of this report, well monitoring conducted by an agency or private firm for a specified length of time in a designated area. A survey typically involves well water sampling and chemical analysis.

**township** – A public land surveying unit which is a square parcel of land, six miles on each side. The location of a township is established as being so many six-mile units east or west of a north-south line running through an initial point (called the “principal meridian”) and so many six-mile units north or south of an east-west line running through another point (called the “baseline”; see also, *well numbering system*).

**triazines** – A class of chemical compounds derived from any of three isomeric compounds, each having three carbon and three nitrogen atoms in a six-membered ring. Triazines are strong inhibitors of photosynthesis. Atrazine, prometon, and simazine are triazines.





**unconfirmed detection** – For a particular well, the detection of a pesticide in a single sample during the time period of an individual monitoring study. Confirmation of the initial detection by a second positive sample was not possible because either (1) only a single sample was taken from the well or (2) analyses of all other samples taken from the well during the study were negative.

**U.S. EPA IRIS RfD** – An oral reference dose that is an estimate of a daily oral exposure to the human population (including sensitive subgroups) that is believed likely to be without an appreciable risk of certain deleterious effects during a lifetime. Expressed in mg/kg/day.

**use requirement** – Restrictions established in regulation for the use of certain pesticides. For example, section 6484.1 (3CCR) states that agricultural, outdoor institutional, and outdoor industrial uses of pesticides containing atrazine are prohibited in the pesticide management zones listed in 6802(c) (3CCR).

**vapor pressure** – A physical property that indicates the rate of evaporation of a compound. The higher the vapor pressure, the more volatile the compound.

**verified detection (DPR study)** – The unequivocal detection of a pesticide or a pesticide breakdown product, or the detection of a chemical in two discrete samples taken from a single well during a 30-day time period, and analyzed either by the same laboratory using different analytical methods or by two laboratories using the same method. The analytical methods used must be approved by DPR. Verification of the presence of a compound in ground water by this criteria fulfills section 13149(d) (FAC) of the PCPA and may be used for regulatory purposes.

**water solubility** – The property of a substance to dissolve in water.

**water well** - any artificial excavation constructed by any method for the purpose of extracting water from, or injecting water into, the underground.

**well head** – The immediate area surrounding the top of a well.

**well numbering system** – The California well numbering system is based on a grid system commonly referred to as the Public Lands Survey. Under this system, all tracts of lands are tied to an initial point and identified as being in a township. A *township* is a square parcel of land six miles on each side. Its location is established as being so many six-mile units east or west of a north-south line running through the initial point (called the “principal meridian”) and so many six-mile units north or south of an east-west line running through the point (called the “baseline”). The meridian lines parallel to, and east or west of, the principal meridian are called *range* lines. Every township is further divided into 36 parts called sections. A *section* is a square parcel of land one mile on a side, each containing 640 acres. Each section of land is divided into sixteen 40-acre tracts. Once the township, range, section, and tract are known, each well is assigned a unique sequence number (in chronological order) by Department of Water Resources (DWR) personnel. This number is known as the State well number.



# **SAMPLING FOR PESTICIDE RESIDUES IN CALIFORNIA WELL WATER**

## **Correction to the 1997 Update of the Well Inventory Database**

**For Sampling Results Reported From  
July 1, 1996 through June 30, 1997**

In the Annual Well Inventory Report "Sampling for Pesticide Residues in California Well Water: 1997 Update to the Well Inventory Database. Twelfth Annual Report to the Legislature, State Department of Health Services, Office of Environmental Health Hazard Assessment, and the State Water Resources Control Board, Pursuant to the Pesticide Contamination Prevention Act." Section III. Pesticide Contamination Prevention Act Annual Report to the Legislature State Water Resources Control Board October 1997 (pages 81-92) was misprinted. That section contains a duplicate of the 1996 actions taken by the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards (RWQCBs).

Attached is the correct 1997 text for Section III. PESTICIDE CONTAMINATION PREVENTION ACT ANNUAL REPORT TO THE LEGISLATURE. STATE WATER RESOURCES CONTROL BOARD OCTOBER 1997.



**California Environmental Protection Agency  
DEPARTMENT OF PESTICIDE REGULATION**

**February 2000**

**EH98-04 - Correction**



**III. PESTICIDE CONTAMINATION PREVENTION ACT  
ANNUAL REPORT TO THE LEGISLATURE  
STATE WATER RESOURCES CONTROL BOARD  
OCTOBER 1997**

Actions taken by the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards (RWQCBs) to prevent economic poisons from migrating to ground waters of the State are as follows:

**A. SWRCB**

SWRCB staff participated in the following activities:

- Reviewed and commented on DPR's proposed regulations to amend AB 2021 (Pesticide Contamination Prevention Act).
- Involved in ongoing consultations with pesticide manufacturers to design monitoring studies and BMPs.
- Regularly attended meetings sponsored by the DPR, including the interagency Pesticide Advisory Committee (PAC), Pesticide Registration and Evaluation Committee (PREC), Pest Management Advisory Committee (PMAC), the Interagency Coordinating Committee for Agricultural Regulatory Programs, and the Air Resources Board's Pesticide Bag Burning Work Group.
- Participated in discussions with U.S. Geological Survey scientists on studies dealing with pesticides and water quality.
- Participated in the California Department of Health Services' Interagency Workgroup to develop Source Water Assessment Program (SWAP) mandated by the 1996 amendments of the Federal Safe Drinking Water Act.
- Participated in outreach with Yolo County growers regarding alternatives to pesticide use through best management practices (BMPs).
- Reviewed, on an ongoing basis, DPR Notices of "Materials Entering Evaluation" and advised DPR on potential water quality impacts of pesticide registration and use decisions.
- Developed draft policy to implement California Toxics Rule, which includes pesticide water quality criteria.



- Reviewed and commented on DPR's proposed studies on pesticide and water quality pursuant to the Management Agency Agreement (MAA) with DPR.
- Authored a book on ecological relevance of toxicity testing results which has been accepted for publication by U.S. Environmental Protection Agency.
- Made several presentations on toxicity testing and its ecological relevance at various professional organizations' annual meetings and conferences.
- Contracted with University of California Cooperative Extension to:
  - Develop alternative agricultural and irrigation practices to prevent or reduce off-site movement of pesticides;
  - Educate growers and others regarding the pesticide-caused problems and outreach the alternative practices to the agricultural community; and
  - Design and initiate monitoring projects to assess the success of the alternative practices.
- Contracted with University of California, Davis' Aquatic Toxicity Laboratory for water quality monitoring (including toxicity testing, toxicity identification evaluations, and chemical analysis) to identify the spatial and temporal extent of the toxicity, as well as the chemical causes and sources of toxicity for the following five projects:
  - Central Valley Codling Moth Pesticide Runoff Project,
  - Sacramento River Watershed Project,
  - Yolo County Resource Conservation District Project,
  - Revlon Slough Project in Ventura County, and
  - Salton Sea Project in Imperial County.

## **B. RWQCB**

Information on actions to prevent economic poisons from migrating to the ground waters of the State by each of the nine RWQCBs is listed in Tables 1 through 10.





Table III-1. Actions taken by the Regional Water Quality Control Board, North Coast (Region I), In FY 1996-97.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Del Norte	Smith River Plains	Aldicarb, 1,2-D	Ongoing monitoring program.
Humboldt	U.S. Forest Service Nursery McKinleyville	Dithiocarbamate	USFS monitoring with RWQCB support.
	Blue Lake Forest Products	Pentachlorophenol, Tetrachlorophenol, Copper 8-Quinolinolate	State Superfund Site with ongoing assessment.
	Carlotta Lumber Company	Pentachlorophenol, Tetrachlorophenol	Ongoing contamination assessment and cleanup.
	Beaver Lumber Company, Arcata	Pentachlorophenol, Tetrachlorophenol	Contamination cleanup.
	Sun Valley Bulb Farms	Chlorothalonil, Dithiocarbamate, Oxamyl	Ongoing monitoring and assessment to prevent discharges to surface water and ground water under RWQCB direction.
	Pacific Lumber Co. Carlotta	Pentachlorophenol Tetrachlorophenol	Ongoing contamination assessment
Mendocino	Marcel Peterson	Chlordane	Remediation underway; new well.
Siskiyou	Mount Heron	Strychnine	Source removal.
	Hi-Ridge Lumber Company	Pentachlorophenol, Tetrachlorophenol	Ongoing contamination assessment and cleanup.
	Pine Mountain Lumber Company	Pentachlorophenol, Tetrachlorophenol	Ongoing contamination assessment and cleanup.
Trinity	Stone Forest Industries, Burnt Ranch	Pentachlorophenol, Tetrachlorophenol	Ongoing contamination assessment.



Table III-2. Actions Taken by the Regional Water Quality Control Board, San Francisco Bay (Region 2),  
In FY 1996-97.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Alameda	Parker & Amchem	2,4-D	No monitoring for 2,4-D is required after many years of non-detect levels of 2,4-D.
	Jones-Hamilton	Pentachlorophenol	RWQCB Order No. 89-110 specified time schedule for investigation/cleanup. Ground water cleanup underway. No sampling of ground water for pesticides.
	Port of Oakland (Embarcadero Cove)	Chlordane, Pentachlorophenol, DDT, Endosulfan, 2,3,7,8-TCDD, DDD	Department of Toxic Substances Control (DTSC) has lead and has approved a Remedial Action Plan including continuous ground water monitoring.
	Lincoln Properties (Orsetti Site)	DDE, 2,4-D	DDE and 2,4-D were non-detect in monitoring wells and are no longer monitored.
	Peerless Southern Pacific Railroad	Pentachlorophenol	City of Berkeley Health Department has lead. Additional soil and ground water investigations required.
	FMC, Newark	EDB	RWQCB Order No. 89-055 specified time schedule for investigation and cleanup. Ground water cleanup underway.
	3830 Old Santa Rita Road, Pleasanton	Dicamba, Dichloroprop, 2,4-D, 2,4,5-T	Pesticide found in grab water samples. One monitoring well installed on-site. Alameda County Department of Environmental Health lead on this site. Site closed October 1990.
Contra Costa	Chevron	Endrin, Lindane, Dieldrin, DDT, Arsenic	Submitted closure plan for Class I impoundment. A cut-off wall with a ground water extraction trench around the impoundment has been constructed.
	Levin Metals	Aldrin, 4,4'-DDD, 4,4'-DDE, o,p,-DDT, Dieldrin, BHC	U.S. Environmental Protection Agency (U.S. EPA) lead on-site cleanup. Awaiting report of completion for remedial dredging project.
	FMC, Richmond	DDT, DDD, DDE, Dieldrin, Chlordane, Tedion, Endosulfan, Ethion, Carbophenothion, Heptachlor	California Department of Health Services (DHS) lead on-site cleanup. Cleanup completed. Monitor to assure remaining pollutants do not migrate.
Marin	Former Sonoma Mosquito Abatement District, San Rafael	DDD, DDE, DDT, Dieldrin	DTSC is lead agency. Some soil removal has already taken place (approximately 3000 yd <sup>3</sup> in 1992). Old monitoring wells destroyed. Seven new wells were installed in 1996. DTSC has mailed out draft deed restriction and draft O&M Agreement for site.



Table III-3. Actions Taken By the Regional Water Quality Control Board, Central Coast (Region 3), In FY 1996-97.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Monterey	Monterey SoilService, King City	EDB, 1,2-D, DDT, DBCP, Toxaphene	Site is being actively remediated.
	WFS-Salinas	Dinoseb	Site is being actively remediated.
	Castlerock Estates	Toxaphene, beta-BHC, delta- BHC, 4,4'-DDE, 4,4'-DDT, 4,4-DDE, 4,4-DDT, 4,4-DDD	Bioremediation pilot study conducted at the site.
Santa Barbara	J.R. Simplot Inc., Guadalupe	Benzene, Toluene, Xylenes	Remediation completed.
Santa Clara	Castle-Veg-Tech, Morgan Hill	Toxaphene, Endrin, Lindane, Endosulfan	Site is being actively remediated.
Santa Cruz	PUREGRO, Watsonville	1,2-DCP	Remediation completed.
	WFS-Greengro, Watsonville	1,2-DCP, Endosulfan	Bioremediation pilot study conducted at the site.
	WFS, Watsonville	DDT, DDD, Toxaphene	Site is being actively remediated.



Table III-4. Actions Taken by the Regional Water Quality Control Board, Los Angeles (Region 4), In FY 1996-97.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Los Angeles	Dominquez Park Landfill, Redondo Beach	Bis (2-ethylhexyl) phthalate	Additional ground water monitoring was required.
	Bixby Village Sanitary Landfill (City Dump Salvage No. 1), Long Beach	Aldrin, Beta-BHC, Alpha-BHC, Bis (2-ethylhexyl) phthalate, Delta-BHC, 4,4'-DDE, 4,4'-DDT, 1,4-Dichlorobenzene, Dieldrin, 2,4-Dinitrophenol, Endosulfan I, Endrin, Endrin aldehyde, Lindane, Heptachlor	Monitoring has not adequately demonstrated that the subject disposal site is not the source of pollutants and listed pesticides detected in ground water monitoring wells downgradient of the disposal site. Two additional semiannual sampling events must be performed for U.S. EPA Method 625. A workplan must be submitted to the RWQCB.
	Market Place Sanitary Landfill (City Dump Salvage No. 2), Long Beach	Alpha-BHC, Bis (2-ethylhexyl) phthalate, Delta-BHC, 4,4'-DDE, 4,4'-DDT, Endosulfan I, Lindane, Heptachlor	Monitoring has not adequately demonstrated that the subject disposal site is not the source of pollutants and listed pesticides detected in ground water monitoring wells downgradient of the disposal site. Two additional semiannual sampling events must be performed for U.S.EPA Method 625. A workplan must be submitted to the RWQCB.
	Studebaker-Loynes Sanitary Landfill (City Dump Salvage No. 3), Long Beach	Alpha-BHC, Bis (2-ethylhexyl) phthalate, 4,4'-DDD, 4,4'-DDE, Di-n-octyl-phthalate, Endosulfan I, Endosulfan II, Endrin, Lindane, Heptachlor	Monitoring has not adequately demonstrated that the subject disposal site is not the source of pollutants and listed pesticides detected in ground water monitoring wells downgradient of the disposal site. Two additional semiannual sampling events must be performed for U.S. EPA Method 625. A workplan must be submitted to the RWQCB.
	Peter Pitchess Honor Rancho Landfill, Castaic Junction	Bis (2-ethylhexyl) phthalate	It appears that the subject landfills may have affected ground water in the vicinity with pesticide and other compounds. Two additional semiannual Solid Waste Assessment Test (SWAT) monitoring events were required. A workplan was also required. Received two additional SWAT monitoring events, with no detections.
	Royal Boulevard Land Reclamation Site, Torrance	Lindane, 1,3-Dichloropropene	The responsible party is monitoring ground water pursuant to their closure requirements. Semiannual data received, under review.
	Port Disposal Landfill, Wilmington	Bis (2-ethylhexyl) phthalate, Di-n-Octyl-phthalate	Chemical compounds were detected in excess of the regulatory levels, and the site was directed to submit a workplan to assess the nature and extent of the releases and to develop a corrective action program.
	Port Disposal Banning Pit and Macco Pit, Wilmington	Bis (2-ethylhexyl) phthalate, Naphthalene, Di-n-Butyl phthalate, 2-Methyl-naphthalene	Chemical compounds were detected in excess of the regulatory levels, and the site was directed to submit a workplan to assess the nature and extent of the releases and to develop a corrective action program.
	City of Compton Landfill	Di(2-ethylhexyl) phthalate (DEHP), Di-n-Octyl-phthalate	Two semiannual ground water monitoring events were required.





Table III-5. Actions Taken By The Regional Water Quality Control Board, Central Valley (Region 5, Sacramento), In FY 1996-97.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Colusa	Moore Aviation	Atrazine, 2,4,5-TP, 2,4-D, 2,4-Dichlorophenol, 4-Nitrophenol	Ground water remediation ongoing. Soils bioremediation complete for most constituents.
Glenn	Barber Cashew Supply Corporation, Willows	Nitrate, ammonia, 1,2-DCE, PCE, TCE, toluene, carbon tetrachloride, chloroform, chlorobenzene	Cleanup and Abatement Order (CAO) issued. Need to define the ground water plume.
Merced	Merced Municipal Airport	1,2 Dichlorobenzene, 1,2 Dichloroethane, 1,2 Dichloroethane (cis), 1,2 Dichloroethane (trans), 1,3 Dichloropropane (cis), Alachlor, Benzene, Captan, Carbophenothion (trithion), Chloroform, DDT (total), Dicofof (Kethane), Dieldrin, Endosulfan I, II, Endosulfan sulfate, Endrin, Endrin aldehyde, Endrin ketone, Ethylbenzene, Heptachlor epoxide, Methoxychlor, Tetrachloroethylene (PCE), Toluene, Toxaphene, TPH-diesel, TPH-gasoline, Trichloroethylene (TCE), Vinyl chloride, Xylenes	Health Assessment completed. Feasibility study submitted.
	J.R. Simplot, Winton	1,2-DCP, Dieldrin, Benefin, 1,2,3-TCP, DBCM, DBCP, Endrin, Alachlor	Ground water remediation underway.
	BAC, Inc.	Chromium, Arsenic, Copper	RWQCB Lead Agency. Ground water extraction and treatment system in pilot study phase. Plume spreading due to ground water flow direction change. Implementing well reinjection, infiltration gallery, and National Pollutant Discharge Elimination System (NPDES) discharges.
	Western Farm Service, Merced	1,2-DCP, DBCP, dinoseb, dalapon, nitrate, ammonia	Off-site assessment underway. MRP issued for quarterly groundwater monitoring.
Sacramento	Sacramento Army Depot	Diazinon, Dursban	Assessment report requested. Federal Superfund work in progress. Cleanup of pesticides completed.
	Natomas Field	Alachlor, Dicofof, DDE, DDT, Toxaphene, Gamma-BHC, Dieldrin	CAO drafted. Meetings have been held with the responsible parties.
	Franklin Field Airport	Toxaphene	Requested feasibility study for soil cleanup and additional ground water sampling.
	McClellan Air Force Base	Aldrin, Alpha-BHC, Beta-BHC, Delta-BHC, Gamma-BHC, (Lindane), 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, Dieldrin, Alpha Endosulfan, Endosulfan Sulfate, Heptachlor, Heptachlor Epoxide, 2,4-D, 2,4,5-T, 2,4,5-TP	Ground water cleanup underway. For the last 4-5 years, no pesticides found in ground water.
	Bureau of Land Management, Fitzgerald Ranch	Toxaphene	Buried empty pesticide containers found on land purchased by Bureau of Land Management (BLM). Soil containing toxaphene excavated and stockpiled onsite. BLM has proposed a pilot study for bioremediation of the stockpiled soils. No pesticides detected in three monitoring wells.



Table III-5. (cont.) Central Valley (Region 5, Sacramento)

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
San Joaquin	Occidental Chemical	EDB, DBCP, Sulfolane	Site remediation occurring pursuant to stipulation and judgement approving settlement (1981).
	Defense Depot, Tracy	Dieldrin, Simazine	Assessment ongoing as part of the site-wide remedial investigations. Draft Remedial Information Report complete.
	Sharpe Army Depot, Stockton	Bromacil	Assessment ongoing.
	Marley Cooling	Arsenic, Copper, Chromium	Ground water cleanup underway.
	U.S. Navy Communication Station	DDD, DDE	Assessment ongoing. Soil removal actions have occurred and more are planned. Ground water assessment underway.
	Triple "E" Produce	Chloroform	Bioremediation began September 1993. A downgradient ground water extraction system began operation in the spring of 1996. The effectiveness of this extraction system is currently being evaluated.
	Pure Gro/Brea Agricultural Service, Stockton	1,2-DCP, Chloroform, PCE, Bromoform, 1,1-DCA, Dibromochloromethane, bromochloromethane, bromodichloromethane	Soil and ground water investigation ongoing. Off-site plume definition continuing. Two soil areas capped. MRP issued for semi-annual ground water monitoring and long-term cap maintenance.
	Former Oxychem/ Simplot/ PureGro	DBCP, 1,2-DCP, 1,1-DCE, 1,2-DCA, Chlorobenzene, 1,1,2-TCA, Mevinphos, Fensulfothion, Dinoseb, Dicamba, 2,4,5-T, Atrazine, Monuron, Carbaryl, Carbofuran, Protham, Diuron, Propoxur, 1,1,2,2-TCA, atraton, 2,4-DB, bromocil, chloromethane, tebuthiuron, simazine, methiocarb, MCP, fenuron, chloroform, chloroxuron, dichloroprop, EDB, oxamyl	Health risk assessment completed. Target cleanup level calculations underway. Off-site plume definition report submitted.
	Cal Farm Supply	b-BHC, Dieldrin, Prometon, Simazine, Atrazine, 2,4,5-TP, Dinoseb	Soils cleaned up. Ground water investigation continues.
	Western Farm Service, Vernalis	DBCP, EDB, diuron, methiocarb, diazinon, aldrin, nitrate, ammonia, 1,2-DCP	Extent of the off-site ground water plume is being defined. MRP issued for quarterly ground water monitoring.
Solano	Wickes Forest Industries	Chromium (Cr <sup>3+</sup> and Cr <sup>6+</sup> ), Arsenic, Copper	Ground water cleanup ongoing.
Stanislaus	Chemurgic Agricultural Chemicals	BHC, DDT	1993 CAO rescinded. Waste Discharge Requirements adopted in June 1997 for a ground water extraction and treatment system. Excavation of areas with elevated BHC in soil completed by December 1995. Ground water monitoring ongoing.
	Geer Road Landfill	1,1-DCA, 1,1,1-TCA, TCE, Chloridazon, Freons	Ground water cleanup underway.
	PureGro, Modesto	DBCP, EDB, nitrate, ammonia	Requested off-site plume definition. Issued MRP for quarterly ground water monitoring.
	Rhone-Poulenc (formerly Union Carbide) Test Plots	Aldicarb	Monitoring has ended and wells were abandoned under the oversight of Stanislaus County Department of Environmental Resources. Site was closed in the spring of 1995.
	Shell Agricultural Research Facility	Cyanazine, Atrazine, Chloroform, Planavin, 1,1-DCE, DBCP, Nitrate	Requested feasibility study for groundwater cleanup.
	Valley Wood	Copper, Chromium, Arsenic	Out-of-court settlement. Federal Superfund site. Interim cleanup in progress.



Table III-5 (cont.) Central Valley (Region 5, Sacramento)

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Sutter	Bowles Flying Service	2,4-D, Thiobencarb, Diuron, Metalaxyl, Molinate, Simazine	Cease and Desist Order issued under the TPCA program. On DTSC's list as needing a Preliminary Endangerment Assessment. Monitoring wells installed.
	PureGro, Robbins	alachlor, aldrin, dicofol, monuron, 1,2-DCA, 1,2-DCP, diphenamid	MRP issued for quarterly ground water monitoring. Additional ground water characterization requested.
Yolo	Frontier Fertilizer Company, Davis	EDB, DCP, DBCP, Carbon tetrachloride	DTSC installed interim ground water treatment system. U.S. EPA expanded the system and is conducting an investigation to determine extent of plume.
	U.C. Davis	Chlorpyrifos, Dicamba, Atrazine, Aldrin, Simazine, Dieldrin, Endrin, DDT	New CAO and MRP issued.
	J.R. Simplot, Courtland	EDB, 2,4-DB, Dicofol, Dicamba, 2,4,5-TP, Carbophenthion, DDT, Dieldrin, Dinoseb, Picloram	Health risk assessment inadequate and must be resubmitted. Ground water remediation underway.

Table III-6. Actions Taken By The Regional Water Quality Control Board, Central Valley (Region 5, Fresno), in FY 1996-97.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Fresno	Blue Hills Disposal Site County of Fresno	Dicamba, 2,4-D, Silvex	Site characterization nearly complete. Corrective action plan will be developed.
	Thompson Hayward Agriculture & Nutrition	Alpha-BHC, Beta-BHC, Gamma-BHC, Dieldrin, DBCP, Diphenamid, Heptachlor, Heptachlor Epoxide	State Superfund site. Contamination assessment ongoing.
	Occidental Chemical/ J.R. Simplot	Dieldrin	Monitoring of ground water continues.
	FMC Corporation	Aldrin, Dieldrin, DDT, DDD, DDE, Heptachlor, Lindane, Toxaphene, Ethyl Parathion, Malathion, Ethion, Endosulfan, Dimethoate, Furan, Dinitroresol, Dinoseb (DNBP)	State Superfund site. Remedial investigation/feasibility study in progress. Interim ground water removal process began December 1994. Final soil RAP approved June 1997.
	Britz, Inc., Five Points	Toxaphene, DDT, DNBP	State Superfund site. Remedial investigation and health assessment report submitted. Soil and ground water remediation feasibility study also submitted. Additional contamination assessment ongoing.
	Fresno County Wells	DBCP, EDB, 1,2-D	Pesticides detected in 146 wells (AB 1803 sampling). San Joaquin Valley DBCP Advisory Committee is overseeing studies on remedial alternatives for DBCP problems.
	Coalinga Airport	DDT, Chlorpyrifos, DEF, Ethion, Disyston	Contamination assessment needed.
	Union Carbide Test Plot	Aldicarb	Additional contamination assessment needed.
	Spain Air	Ethion, DEF, Parathion, Trithion, Dinoseb, Paraquat, DDE, DDT, Endosulfan II	Assessment needed.



Table III-6 (cont.) Central Valley (Region 5, Fresno)

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Kern	Brown & Bryant, Inc., Arvin	1,2-D, 1,3-D, DBCP, Dinoseb, EDB	Federal Superfund site. U.S. EPA has prepared Remedial Information Feasibility Study Report.
	Puregro Company, Bakersfield	DBCP	State Superfund site. Further assessment conducted. The waste discharge requirements for closure of a former dry well were issued March 1994 and amended March 1996.
	Guimarra Vineyard	DBCP	Contamination assessment and pond closure plan needed.
	Dick Garriott Crop Dusting, Bakersfield	Chlordane, DDE, DDT, PCNB, Endosulfan I & II, Methoxychlor, Carbofuran, Carbaryl, Bufencarb, DEF, Tedion, Diazinon, Chlorpyrifos, Ethyl Parathion, Diuron, Dinoseb, Dicamba	CAO issued in 1993. TPCA site. Hydrogeological Assessment Report completed in 1993. Work in progress to determine extent of ground water degradation. Impoundment is covered.
	USDA, Shafter	Dichlobenil, EPTC, Prometryne, DDT, DDE, DDD, Dieldrin, Toxaphene, Silvex, PCP, Chlorpropham, Ametryn, Atrazine	Developing a closure plan.
	Brown and Bryant, Inc., Shafter	Chlordane, DDD, DDE, DDT, Dieldrin, Endrin, Heptachlor, Toxaphene	State Superfund site. Contamination assessment ongoing.
	Kern County Wells	DBCP, 1,2-D, EDB	Pesticides detected in 57 wells (AB 1803 sampling). No assessment underway.
Madera	Chowchilla Municipal Airport	Dieldrin, Alpha-BHC, Endosulfan, PCNB, DDT, DDE, Lindane	Contamination assessment needed.
	Madera County Wells	DBCP, 1,2-D, EDB	DBCP detected in two wells (AB 1803 sampling). No assessment underway.
	Western Farm Service, Inc.	Dinoseb, DBCP, Dieldrin	Assessment ongoing. Impoundment closed. Impacted soils have been capped.
	Madera Municipal Airport	DDT, DDE, Toxaphene, Dicofol, Endrin	Soil and ground water investigation underway. Impacted soils will be capped.
Kings	Lemoore N.A.S.	Unspecified	Investigation ongoing.
	Blair Field	2,4-D, Dicofol, Diazinon, Propargite	Assessment needed.
	Blair Aviation	Trifluralin, Mevinphos, Phorate	Contamination assessment needed.
	Lakeland Dusters	DDT, Toxaphene	Contaminated soils excavated and stockpiled on site. Remediation underway.
Tulare	Mefford Field, City of Tulare	p,p'-DDT, p,p'-DDE, 2,4,5-TCP, Dicamba, DNBP, Diuron	Contamination assessment and mitigation reports needed.
	Tulare Airport	2,4-D, DNBP	Assessment needed.
	Kaweah Crop Dusters	DDT, 2,4-D, 2,4,5-T, Methoxychlor	DHS Remedial Action Order issued January 1984. Cleanup ongoing.
	Tulare County Wells	1,2-D	Detected in wells through AB 1803 sampling. No assessment underway.
Tuolumne	Tuolumne County Wells	Methylene Chloride	Detected in one well (AB 1803 sampling).
Yuba	Beale Air Force Base	Lindane	Ground water investigation underway.





Table III-7. Actions Taken By The Regional Water Quality Control Board, Lahontan (Region 6), In FY 1996-97.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Inyo	Haiwee Reservoir	Copper sulfate	Potential for ground water contamination will be evaluated.

Table III-8. Actions Taken By the Regional Water Quality Control Board, Colorado River Basin (Region 7), In FY 1996-97.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Imperial	Central Brave Agricultural Service	4,4'-DDE, Endosulfan	Recalcitrant Discharger. Referred to Attorney General for nonpayment of fees.
	City of Brawley	4,4'-DDE, Dieldrin	Contaminated soil excavated and transported to Class I facility. Site closed.
	Visco Flying Service	4,4'-DDE, 4,4'-DDD, 4,4'-DDT, Endosulfan I & II	Impoundment remediated, capped, and closed in place.
	J.R. Simplot Company, Sandin Siding Facility	Dieldrin, 4,4'-DDT, Endrin	CAO issued. Site in remediation. Risk base corrective action in-progress.
	Stoker Company	Endosulfan I & II, Dinoseb, 2,4-DB	Land treatment facility undergoing closure.
	Ross Flying Service	4,4'-DDD, 4,4'-DDE, 4,4'-DDT, Dieldrin	Closure of surface impoundment.
Riverside	West Coast Flying	Endosulfan I & II, Disulfoton	Recalcitrant discharger. Referred to Attorney General for nonpayment of fees.
	Woten Aviation Services	Disyston, DEF, Ethyl Parathion, Methyl Parathion	CAO issued. U.S. EPA has lead in cleanup.
	Foster Gardner, Inc., Coachella Facility	1,2-Dichloroethane, 1,2-D, Ethylene Dibromide	CAO issued October 1991 by RWQCB. Imminent and Substantial Endangerment Order issued by DTSC on August 21, 1992. Cleanup on-going.
	Farmers Aerial Service, Inc.	4,4'-DDE, Endosulfan I	Closure of disposal area.
	Coachella Valley Mosquito Abatement District	DDT	Under investigation. Pesticide contamination insignificant, UST Cleanup only.
	Crop Production Services, Blythe (Formerly Pure Gro MW-24)	1,2-Dichloropropane	Undergoing cleanup.



Table III-9. Actions Taken By The Regional Water Quality Control Board, Santa Ana (Region 8), In FY 1996-97.

There are currently 103 confirmed detections of pesticides in the Santa Ana Region. Only one of these has been attributed to a point source discharge. Ground water extraction and treatment at this site is being performed under an order issued by the RWQCB. With the exception of this, all detections on this list are from domestic and agricultural production wells. One hundred and one of these wells contain dibromochloropropane (DBCP), four contain simazine, and one contains 1,2-dichloropropene (three wells contain both DBCP and simazine).

The presence of DBCP in the Region's ground water has resulted in both an actual and threatened impact on the beneficial use of water as a drinking water supply since 80 of the 101 wells containing DBCP are drinking water wells.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Orange	Great Lakes Chemical Corporation (formerly Great Western Savings), Irvine	1,2-D, EDB, 1,2-DCE	A new NPDES permit was issued July 7, 1995. Ground water extraction and treatment continuing. GLCC was issued a CAO by RWQCB on 4/17/97 for off-site remediation of impacted ground water.
Riverside	Sunnymead Mutual Water Company (North and South Well)	DBCP	Both wells were sold to Eastern Municipal Water District in February 1991. Customers are being served by the new District from other supply sources. North Well has been completely rehabilitated. South Well will be used for emergency purposes only.
	Arlington Basin	DBCP	Construction of a 7 MGD reverse osmosis plant with partial flow through a GAC unit for treatment of TDS, NO <sub>3</sub> and DBCP was completed in September 1990. About 4 MGD of ground water is treated and 2 MGD is bypassed. Treated water is mixed with the bypassed water and discharged to a local channel for ground water recharge purposes. Salt brine (0.8 MGD) is discharged to the Santa Ana Regional Interceptor which discharges to the ocean via the Orange County sewage treatment plant. A second parallel transmission line has been completed to bring extracted ground water from three wells to the reverse osmosis unit. Possible sale of this water to City of Corona in near future.
	City of Corona (Well 8, mun.)	Simazine	Well has been completely rehabilitated. Simazine was not detected in the sampling after rehabilitation work. No further action being taken. Trace of TCE has been detected in recent sampling. No further action being taken.
	Home Gardens County Water District (Wells 2 & 3, mun.)	DBCP, Simazine	Water purveyor has closed these wells and is now purchasing water from the City of Riverside.
	City of Riverside, Twin Spring, mun.	DBCP	Well is out of service. No mitigation measures in effect.
	Victoria Farms MWC (Well 01 & 03, mun.)	DBCP	Water purveyor has closed these wells and is now purchasing water from the City of San Bernardino.
	City of Corona (Well 17, mun.)	Simazine, DBCP	Well is being used. Trace of DBCP was detected in March 1991 sampling. Trace of TCE has been detected in recent sampling.
	City of Riverside (Russell "B")	Simazine, DBCP	Water is being blended with other supply wells in the area.
	City of Riverside (1st Street)	DBCP	Well is not being used due to high concentrations of DBCP. No mitigation measures in effect.
	City of Riverside (Electric Street, mun.)	DBCP	Well water is being blended with water from other supply wells; blended water is sampled on a bi-weekly basis.
	City of Riverside (Palmyrita, mun.)	DBCP	Well is not being used due to high concentrations of DBCP. No mitigation measures in effect.
	City of Riverside (3 wells, mun.)	DBCP	Water from Hunt Wells No. 6, 10, and 11 is being blended with other wells in the area.
	City of Riverside (3 wells, emergency, Downtown Riverside)	DBCP	No mitigation measures in effect. These three wells are also contaminated with industrial organic solvents.



Table III-9 (cont.) Santa Ana (Region 8).

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
Riverside	Riverside County Hall Record, (pr)	DBCP	No mitigation measures in effect. Volatile organic chemicals such as Trichloroethylene and Perchloroethylene have also been found. Well is used for emergency purposes only.
	Loma Linda University, Arlington, (Wells 1 & 2, mun.)	DBCP	The University water supply system is tied into the City of Riverside domestic water supply distribution system. These two wells are used for irrigation purposes at the school.
	City of Riverside (Moor-Griffith, mun.)	DBCP	Well is out of service.
	Lake Hemet MWD (Wells A and B, mun.)	DBCP	Well A is being used for irrigation purposes by the District. Well B is being used by a local farmer for irrigation purposes.
	Buschlen, Dwight (mun.)	DBCP	Well was abandoned about nine years ago. A second well on the property with traces of DBCP is being used for irrigation only.
San Bernardino	Gage System Wells (12 wells, mun.)	DBCP	The City of Riverside operates the Gage System which consists of 15 wells located along the Santa Ana River. These wells are being blended for domestic use. Trace amounts of radon have been detected in some of these wells. The City installed three deep wells in the area to increase blending capacity. New wells are in operation.
	Bunker Hill Basin: Crafton/Redlands area (36 wells)	DBCP	The City of Redlands started construction of a 6,000 gpm granular activated carbon (GAC) treatment system in September 1991. This GAC system treats ground water from two wells. Treated water is being put into the local water supply distribution system. Funding for this system is from the SWRCB (\$2.8 million) and bond money through the State Expenditure Plan (\$1.9 million) which is managed by DTSC. The system has been off line since July 1997 due to presence of perchlorate above provisional Action Level in both production wells..
San Bernardino	South San Bernardino Company Water District (4 wells, mun.)	DBCP	All four wells are out of service. The City of San Bernardino Water Department purchased the water district in July 1991. The City now supplies all the customers in the area.
	Cucamonga CWD (4 wells, mun.)	DBCP	Well No. 13 has not been used since 1991. The other three wells are standby wells and are used on a limited basis. Water is being purchased from Metropolitan Water District (MWD).
	Monte Vista CWD (3 wells, mun.)	DBCP	All three wells are on standby status. Water is being purchased from MWD.
	City of Upland (14 wells)	DBCP	Seven wells are out of operation. Three wells are currently on standby. Four wells are being used and are being blended with other supply wells.
	City of Loma Linda (6 wells, mun.)	DBCP	Two wells have been abandoned. One well is out of operation due to high nitrates. The City also purchases treated water from the City of San Bernardino. A new well will be on line next year.

Table III-10. Actions Taken By The Regional Water Quality Control Board, San Diego (Region 9), In FY 1996-97.

COUNTY	SITE	PESTICIDE	PREVENTION ACTION
San Diego	City of Oceanside Water Utility District (Well No. 12-11S/ 4W-18L1 S)	1,2-DCP (1,2-Dicloropropane)	This backup drinking water well is located in the San Luis Rey River Valley. Up to 2.3 ppm has been detected in this well. The City of Oceanside is continuing monitoring of this well and reports to the State's DHS.
	Truly Nolen Exterminating, Inc.	Aldrin, Dieldrin, Chlordane	This is an on-site abandoned well which allegedly received pesticide wastes several years ago. Contaminated soil has been removed. Trace levels still exist in ground water. No further monitoring required. (RWQCB lead)
	San Pasqual Valley Union School (three wells)	Ethylene dibromide	Three drinking water wells impacted with Ethylene dibromide above MCL. City of San Diego monitored the wells until last year, wells were washed out by flood in 1993.

